



US Army Corps  
of Engineers  
Savannah District

# **Seymour Johnson AFB North Carolina**

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**Solicitation Number  
DACA21-01-R-0060  
Operations, Maintenance and Storage Facilities  
FY-02, Line Item VKAG001162  
Volume II of III  
Divisions 3 through 12  
December 2001**

**THIS SOLICITATION IS UNRESTRICTED PURSUANT TO THE  
"BUSINESS OPPORTUNITY DEVELOPMENT REFORM ACT OF 1988"  
(PUBLIC LAW 100-656)**

**U.S. ARMY ENGINEER DISTRICT, SAVANNAH  
CORPS OF ENGINEERS  
100 WEST OGLETHORPE AVENUE  
SAVANNAH, GEORGIA 31401-3640**

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CEGS-03100 (May 1998)

Includes changes through Notice 1 (March 2001)

SECTION 03100

STRUCTURAL CONCRETE FORMWORK  
**05/98**

Includes Special Change (Submittal Paragraph)(June/August 2000)

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

ACI INTERNATIONAL (ACI)

ACI 347R (1994) Guide to Formwork for Concrete

AMERICAN HARDBOARD ASSOCIATION (AHA)

AHA ANSI/AHA A135.4 (1995) Basic Hardboard

DEPARTMENT OF COMMERCE (DOC)

DOC PS 1 (1996) Voluntary Product Standard -  
Construction and Industrial Plywood

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-03 Product Data

Form Materials

Manufacturer's data including literature describing form materials, accessories, and form releasing agents.

Form Releasing Agents

Manufacturer's recommendation on method and rate of application

of form releasing agents.

### 1.3 DESIGN

Formwork shall be designed in accordance with methodology of ACI 347R for anticipated loads, lateral pressures, and stresses. Forms shall be capable of producing a surface which meets the requirements of the class of finish specified in Section 03300 CAST-IN-PLACE STRUCTURAL CONCRETE. Forms shall be capable of withstanding the pressures resulting from placement and vibration of concrete.

### 1.4 OMITTED

## PART 2 PRODUCTS

### 2.1 FORM MATERIALS

#### 2.1.1 Forms For Class B Finish

Forms for Class B finished surfaces shall be plywood panels conforming to DOC PS 1, Grade B-B concrete form panels, Class I or II. Other form materials or liners may be used provided the smoothness and appearance of concrete produced will be equivalent to that produced by the plywood concrete form panels. Forms for round columns shall be the prefabricated seamless type.

#### 2.1.2 Forms For Class C Finish

Forms for Class C finished surfaces shall be shiplap lumber; plywood conforming to DOC PS 1, Grade B-B concrete form panels, Class I or II; tempered concrete form hardboard conforming to AHA ANSI/AHA A135.4; other approved concrete form material; or steel, except that steel lining on wood sheathing shall not be used. Forms for round columns may have one vertical seam.

#### 2.1.3 Omitted

#### 2.1.4 Retain-In-Place Metal Forms

Retain-in-place metal forms for concrete slabs and roofs shall be as specified in Section 05300 STEEL DECKING.

#### 2.1.5 Omitted

#### 2.1.6 Form Ties

Form ties shall be factory-fabricated metal ties, shall be of the removable or internal disconnecting or snap-off type, and shall be of a design that will not permit form deflection and will not spall concrete upon removal. Solid backing shall be provided for each tie. Except where removable tie rods are used, ties shall not leave holes in the concrete surface less than 1/4 inch nor more than 1 inch deep and not more than 1 inch in diameter. Removable tie rods shall be not more than 1-1/2 inches in diameter.

#### 2.1.7 Form Releasing Agents

Form releasing agents shall be commercial formulations that will not bond with, stain or adversely affect concrete surfaces. Agents shall not impair subsequent treatment of concrete surfaces depending upon bond or adhesion nor impede the wetting of surfaces to be cured with water or curing compounds.

### PART 3 EXECUTION

#### 3.1 INSTALLATION

##### 3.1.1 Formwork

Forms shall be mortar tight, properly aligned and adequately supported to produce concrete surfaces meeting the surface requirements specified in Section 03300 CAST-IN-PLACE STRUCTURAL CONCRETE and conforming to construction tolerance given in TABLE 1. Where concrete surfaces are to have a Class A or Class B finish, joints in form panels shall be arranged as approved. Where forms for continuous surfaces are placed in successive units, the forms shall fit over the completed surface to obtain accurate alignment of the surface and to prevent leakage of mortar. Forms shall not be reused if there is any evidence of surface wear and tear or defects which would impair the quality of the surface. Surfaces of forms to be reused shall be cleaned of mortar from previous concreting and of all other foreign material before reuse. Form ties that are to be completely withdrawn shall be coated with a nonstaining bond breaker.

##### 3.2 CHAMFERING

Except as otherwise shown, external corners that will be exposed shall be chamfered, beveled, or rounded by moldings placed in the forms.

##### 3.3 COATING

Forms for Class B finished surfaces shall be coated with a form releasing agent before the form or reinforcement is placed in final position. The coating shall be used as recommended in the manufacturer's printed or written instructions. Forms for Class C finished surfaces may be wet with water in lieu of coating immediately before placing concrete, except that in cold weather with probable freezing temperatures, coating shall be mandatory. Surplus coating on form surfaces and coating on reinforcing steel and construction joints shall be removed before placing concrete.

##### 3.4 REMOVAL OF FORMS

Forms shall be removed preventing injury to the concrete and ensuring the complete safety of the structure. Formwork for columns, walls, side of beams and other parts not supporting the weight of concrete may be removed when the concrete has attained sufficient strength to resist damage from the removal operation but not before at least 24 hours has elapsed since concrete placement. Supporting forms and shores shall not be removed from beams, floors and walls until the structural units are strong enough to carry their own weight and any other construction or natural loads.



Supporting forms or shores shall not be removed before the concrete strength has reached 70 percent of design strength, as determined by field cured cylinders or other approved methods. This strength shall be demonstrated by job-cured test specimens. The job-cured test specimens for form removal purposes shall be provided in numbers as directed and shall be in addition to those required for concrete quality control. The specimens shall be removed from molds at the age of 24 hours and shall receive, insofar as possible, the same curing and protection as the structures they represent.

TABLE 1

TOLERANCES FOR FORMED SURFACES

|   |   |
|---|---|
| 1. Variations from the plumb:   | In any 10 feet of length ----- 1/4 inch   |
| a. In the lines and surfaces of columns, piers, walls and in arises                                     | Maximum for entire length ----- 1 inch  |
| b. For exposed corner columns, control-joint grooves, and other conspicuous lines                       | In any 20 feet of length ----- 1/4 inch<br>Maximum for entire length----- 1/2 inch                                    |
| 2. Variation from the level or from the grades indicated on the drawings:                               | In any 10 feet of length -----1/4 inch<br>In any bay or in any 20 feet of length----- 3/8 inch                        |
| a. In slab soffits, ceilings, beam soffits, and in arises, measured before removal of supporting shores | Maximum for entire length ----- 3/4 inch  |
| b. In exposed lintels, sills, parapets, horizontal grooves, and other conspicuous lines                 | In any bay or in any 20 feet of length ----- 1/4 inch<br>Maximum for entire length----- 1/2 inch                      |
| 3. Variation of the linear building lines from established position in plan                             | In any 20 feet ----- 1/2 inch<br>Maximum -----1 inch  |
| 4. Variation of distance between walls, columns, partitions   | 1/4 inch per 10 feet of distance, but not more than 1/2 inch in any one bay, and not more than 1 inch total variation |

TABLE 1

TOLERANCES FOR FORMED SURFACES

|                      |  |   |
|----------------------|--|---|
| 5.                   | Variation in the sizes and locations of sleeves, floor openings, and wall opening                    | Minus ----- 1/4 inch<br>Plus ----- 1/2 inch   |
| 6.                   | Variation in cross-sectional dimensions of columns and beams and in the thickness of slabs and walls | Minus ----- 1/4 inch<br>Plus ----- 1/2 inch   |
| 7.                   | Footings:  |   |
| a.                   | Variation of dimensions in plan  | Minus ----- 1/2 inch<br>Plus ----- 2 inches<br>when formed or plus 3 inches<br>when placed against unformed<br>excavation |
| b.                   | Misplacement of eccentricity   | 2 percent of the footing<br>width in the direction of<br>misplacement but not more than<br>2 inches                       |
| c.                   | Reduction in thickness of specified thickness  | Minus ----- 5 percent   |
| 8.                   | Variation in steps:  | Riser ----- 1/8 inch  |
| a.                   | In a flight of stairs  | Tread ----- 1/4 inch  |
| b.                   | In consecutive steps   | Riser ----- 1/16 inch<br>Tread ----- 1/8 inch   |
| -- End of Section -- |  |   |

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CEGS-03150 (May 1998)

Includes changes through Notice 1 (October 2000)

SECTION 03150

EXPANSION JOINTS, CONTRACTION JOINTS, AND WATERSTOPS  
**05/98**

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS  
(AASHTO)

AASHTO T 111 (1983; R 1996)) Inorganic Matter or Ash in  
Bituminous Materials

AMERICAN HARDBOARD ASSOCIATION (AHA)

AHA A135.4 (1995) Basic Hardboard

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 109/A 109M (1998a) Steel, Strip, Carbon, Cold-Rolled

ASTM A 167 (1999) Stainless and Heat-Resisting  
Chromium-Nickel Steel Plate, Sheet, and  
Strip

ASTM A 480/A 480M (1999b) General Requirements for  
Flat-Rolled Stainless and Heat-Resisting  
Steel Plate, Sheet, and Strip

ASTM A 570/A 570M (1998) Steel, Sheet and Strip, Carbon,  
Hot-Rolled, Structural Quality

ASTM B 370 (1998) Copper Sheet and Strip for Building  
Construction

ASTM C 919 (1984; R 1998) Use of Sealants in  
Acoustical Applications

ASTM C 920 (1998) Elastomeric Joint Sealants

|             |  |
|-------------|--|
| ASTM D 4    | (1986; R 1998) Bitumen Content   |
| ASTM D 6    | (1995) Loss on Heating of Oil and Asphaltic Compounds  |
| ASTM D 412  | (1998a) Vulcanized Rubber and Thermoplastic Rubbers and Thermoplastic Elastomers - Tension   |
| ASTM D 471  | (1998el) Rubber Property - Effect of Liquids   |
| ASTM D 1190 | (1997) Concrete Joint Sealer, Hot-Applied Elastic Type   |
| ASTM D 1191 | (1984; R 1994el)<br>Concrete Joint Sealers   |
| ASTM D 1751 | (1999) Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)        |
| ASTM D 1752 | (1984; R 1996el) Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction                    |
| ASTM D 1854 | (1996) Jet-Fuel-Resistant Concrete Joint Sealer, Hot-Poured Elastic Type   |
| ASTM D 2628 | (1991; R 1998) Preformed Polychloroprene Elastomeric Joint Seals for Concrete Pavements  |
| ASTM D 2835 | (1989; R 1998) Lubricant for Installation of Preformed Compression Seals in Concrete Pavements   |
| ASTM D 5249 | (1995) Backer Material for Use With Cold and Hot-Applied Joint Sealants in Portland-Cement Concrete and Asphalt Joints                       |
| ASTM D 5329 | (1996) Standard Test Method for Sealants and Fillers, Hot-Applied, for Joints and Cracks in Asphaltic and Portland Cement Concrete Pavements |

CORPS OF ENGINEERS (COE)

|               |  |
|---------------|--|
| COE CRD-C 513 | (1974) Corps of Engineers Specifications for Rubber Waterstops |
|---------------|--|

COE CRD-C 572

(1974) Corps of Engineers Specifications  
for Polyvinylchloride Waterstop

## 1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

### SD-02 Shop Drawings

#### Waterstops

Shop drawings and fabrication drawings provided by the manufacturer or prepared by the Contractor.

### SD-03 Product Data

Preformed Expansion Joint Filler  
Sealant  
Waterstops

Manufacturer's literature, including safety data sheets, for preformed fillers and the lubricants used in their installation; field-molded sealants and primers (when required by sealant manufacturer); preformed compression seals; and waterstops.

Preformed Expansion Joint Filler  
Sealant  
Waterstops

Manufacturer's recommended instructions for installing preformed fillers, field-molded sealants; preformed compression seals; and waterstops; and for splicing non-metallic waterstops.

### SD-04 Samples

#### Lubricant for Preformed Compression Seals

Specimens identified to indicate the manufacturer, type of material, size and quantity of material, and shipment or lot represented. Each sample shall be a piece not less than 9 ft of 1 inch nominal width or wider seal or a piece not less than 12 ft of compression seal less than 1 inch nominal width. One quart of lubricant shall be provided.

#### Field-Molded Type

One gallon of field-molded sealant and one quart of primer (when primer is recommended by the sealant manufacturer) identified to indicate manufacturer, type of material, quantity, and shipment or lot represented.

#### Non-metallic Materials

Specimens identified to indicate manufacturer, type of material, size, quantity of material, and shipment or lot represented. Each sample shall be a piece not less than 12 inch long cut from each 200 ft of finished waterstop furnished, but not less than a total of 4 ft of each type, size, and lot furnished. One splice sample of each size and type for every 50 splices made in the factory and every 10 splices made at the job site. The splice samples shall be made using straight run pieces with the splice located at the mid-length of the sample and finished as required for the installed waterstop. The total length of each splice shall be not less than 12 inches long.

#### SD-07 Certificates

Preformed Expansion Joint Filler  
Sealant  
Waterstops

Certificates of compliance stating that the joint filler and sealant materials and waterstops conform to the requirements specified.

### 1.3 DELIVERY AND STORAGE

Material delivered and placed in storage shall be stored off the ground and protected from moisture, dirt, and other contaminants. Sealants shall be delivered in the manufacturer's original unopened containers. Sealants whose shelf life has expired shall be removed from the site.

## PART 2 PRODUCTS

### 2.1 CONTRACTION JOINT STRIPS

Contraction joint strips shall be 1/8 inch thick tempered hardboard conforming to AHA A135.4, Class 1. In lieu of hardboard strips, rigid polyvinylchloride (PVC) or high impact polystyrene (HIPS) insert strips specifically designed to induce controlled cracking in slabs on grade may be used. Such insert strips shall have removable top section.

### 2.2 PREFORMED EXPANSION JOINT FILLER

Expansion joint filler shall be preformed material conforming to ASTM D 1751 or ASTM D 1752. Unless otherwise indicated, filler material shall be 1/2 inch thick and of a width applicable for the joint formed. Backer material, when required, shall conform to ASTM D 5249.

### 2.3 SEALANT

Joint sealant shall conform to the following:

#### 2.3.1 Preformed Polychloroprene Elastomeric Type



ASTM D 2628.

#### 2.3.2 Lubricant for Preformed Compression Seals

ASTM D 2835.

#### 2.3.3 Hot-Poured Type

ASTM D 1190 tested in accordance with ASTM D 1191.

#### 2.3.4 Field-Molded Type

ASTM C 920, Type M for horizontal joints or Type NS for vertical joints, Class 25, and Use NT. Bond breaker material shall be polyethylene tape, coated paper, metal foil or similar type materials. The back-up material shall be compressible, non-shrink, nonreactive with sealant, and non-absorptive material type such as extruded butyl or polychloroprene rubber.

#### 2.3.5 Hot-Applied Jet-Fuel Resistant Type

ASTM D 1854 tested in accordance with ASTM D 5329.

### 2.4 WATERSTOPS

Intersection and change of direction waterstops shall be shop fabricated.

#### 2.4.1 Flexible Metal

Copper waterstops shall conform to ASTM B 152 and ASTM B 370, O60 soft anneal temper and 20 oz mass per sq ft sheet thickness. Stainless steel waterstops shall conform to ASTM A 167 and ASTM A 480/A 480M, UNS S30453 (Type 304L), and 20 gauge thick strip.

#### 2.4.2 Rigid Metal

Flat steel waterstops shall conform to ASTM A 109/A 109M, No. 2 (half hard) temper, No. 2 edge, No. 1 (matte or dull) finish or ASTM A 570/A 570M, Grade 40.

#### 2.4.3 Non-Metallic Materials`

Non-metallic waterstops shall be manufactured from a prime virgin resin; reclaimed material is not acceptable. The compound shall contain plasticizers, stabilizers, and other additives to meet specified requirements. Rubber waterstops shall conform to COE CRD-C 513. Polyvinylchloride waterstops shall conform to COE CRD-C 572. Thermoplastic elastomeric rubber waterstops shall conform to ASTM D 471.

#### 2.4.4 Non-Metallic Hydrophilic

Swellable strip type compound of polymer modified chloroprene rubber that swells upon contact with water shall conform to ASTM D 412 as follows:

Tensile strength 420 psi minimum; ultimate elongation 600 percent minimum.  
Hardness shall be 50 minimum on the type A durometer and the volumetric expansion ratio in distilled water at 70 degrees F shall be 3 to 1 minimum.

#### 2.4.5 Preformed Elastic Adhesive

Preformed plastic adhesive waterstops shall be produced from blends of refined hydrocarbon resins and plasticizing compounds reinforced with inert mineral filler, and shall contain no solvents, asbestos, irritating fumes or obnoxious odors. The compound shall not depend on oxidizing, evaporating, or chemical action for its adhesive or cohesive strength.

##### 2.4.5.1 Chemical Composition

The chemical composition of the sealing compound shall meet the requirements shown below:

| PERCENT BY WEIGHT             |      |      |              |
|-------------------------------|------|------|--------------|
| COMPONENT                     | MIN. | MAX. | TEST         |
| Bitumen (Hydrocarbon plastic) | 50   | 70   | ASTM D 4     |
| Inert Mineral Filler          | 30   | 50   | AASHTO T 111 |
| Volatile Matter               |      | 2    | ASTM D 6     |

##### 2.4.5.2 Adhesion Under Hydrostatic Pressure

The sealing compound shall not leak at the joints for a period of 24 hours under a vertical 6 foot head pressure. In a separate test, the sealing compound shall not leak under a horizontal pressure of 10 psi which is reached by slowly applying increments of 2 psi every minute.

##### 2.4.5.3 Sag of Flow Resistance

Sagging shall not be detected when tested as follows: Fill a wooden form 1 inch wide and 6 inches long flush with sealing compound and place in an oven at 135 degrees F in a vertical position for 5 days.

##### 2.4.5.4 Chemical Resistance

The sealing compound when immersed separately in a 5% solution of caustic potash, a 5% solution of hydrochloric acid, 5% solution of sulfuric acid and a saturated hydrogen sulfide solution for 30 days at ambient room temperature shall show no visible deterioration.

### PART 3 EXECUTION

#### 3.1 JOINTS

Joints shall be installed at locations indicated and as authorized.

##### 3.1.1 Contraction Joints

Contraction joints may be constructed by inserting tempered hardboard

strips or rigid PVC or HIPS insert strips into the plastic concrete using a steel parting bar, when necessary, or by cutting the concrete with a saw after concrete has set. Joints shall be approximately 1/8 inch wide and shall extend into the slab one-fourth the slab thickness, minimum, but not less than 1 inch.

#### 3.1.1.1 Joint Strips

Strips shall be of the required dimensions and as long as practicable. After the first floating, the concrete shall be grooved with a tool at the joint locations. The strips shall be inserted in the groove and depressed until the top edge of the vertical surface is flush with the surface of the slab. The slab shall be floated and finished as specified. Working of the concrete adjacent to the joint shall be the minimum necessary to fill voids and consolidate the concrete. Where indicated, the top portion of the strip shall be sawed out after the curing period to form a recess for sealer. The removable section of PVC or HIPS strips shall be discarded and the insert left in place. True alignment of the strips shall be maintained during insertion.

#### 3.1.1.2 Sawed Joints

Joint sawing shall be early enough to prevent uncontrolled cracking in the slab, but late enough that this can be accomplished without appreciable spalling. Joints shall be cut no later than 8 hours after concrete placement. Concrete sawing machines shall be adequate in number and power, and with sufficient replacement blades to complete the sawing at the required rate. Joints shall be cut to true alignment and shall be cut in sequence of concrete placement. Sludge and cutting debris shall be removed.

#### 3.1.2 Expansion Joints

Preformed expansion joint filler shall be used in expansion and isolation joints in slabs around columns and between slabs on grade and vertical surfaces where indicated. The filler shall extend the full slab depth, unless otherwise indicated. The edges of the joint shall be neatly finished with an edging tool of 1/8 inch radius, except where a resilient floor surface will be applied. Where the joint is to receive a sealant, the filler strips shall be installed at the proper level below the finished floor with a slightly tapered, dressed and oiled wood strip temporarily secured to the top to form a recess to the size shown on the drawings. The wood strip shall be removed after the concrete has set. Contractor may opt to use a removable expansion filler cap designed and fabricated for this purpose in lieu of the wood strip. The groove shall be thoroughly cleaned of laitance, curing compound, foreign materials, protrusions of hardened concrete, and any dust which shall be blown out of the groove with oil-free compressed air.

#### 3.1.3 Joint Sealant

Sawed contraction joints and expansion joints in slabs shall be filled with joint sealant, unless otherwise shown. Joint surfaces shall be clean, dry, and free of oil or other foreign material which would adversely affect the bond between sealant and concrete. Joint sealant shall be applied as

recommended by the manufacturer of the sealant.

#### 3.1.3.1 Joints With Preformed Compression Seals

Compression seals shall be installed with equipment capable of installing joint seals to the prescribed depth without cutting, nicking, twisting, or otherwise distorting or damaging the seal or concrete and with no more than 5 percent stretching of the seal. The sides of the joint and, if necessary, the sides of the compression seal shall be covered with a coating of lubricant. Butt joints shall be coated with liberal applications of lubricant.

#### 3.1.3.2 Joints With Field-Molded Sealant

Joints shall not be sealed when the sealant material, ambient air, or concrete temperature is less than 40 degrees F. When the sealants are meant to reduce the sound transmission characteristics of interior walls, ceilings, and floors the guidance provided in ASTM C 919 shall be followed.

Joints requiring a bond breaker shall be coated with curing compound or with bituminous paint. Bond breaker and back-up material shall be installed where required. Joints shall be primed and filled flush with joint sealant in accordance with the manufacturer's recommendations.

### 3.2 WATERSTOPS, INSTALLATION AND SPLICES

Waterstops shall be installed at the locations shown to form a continuous water-tight diaphragm. Adequate provision shall be made to support and completely protect the waterstops during the progress of the work. Any waterstop punctured or damaged shall be repaired or replaced. Exposed waterstops shall be protected during application of form release agents to avoid being coated. Suitable guards shall be provided to protect exposed projecting edges and ends of partially embedded waterstops from damage when concrete placement has been discontinued. Splices shall be made by certified trained personnel using approved equipment and procedures.

#### 3.2.1 Copper And Stainless Steel

Splices in copper waterstops shall be lap joints made by brazing. Splices in stainless steel waterstops shall be welded using a TIG or MIG process utilizing a weld rod to match the stainless. All welds shall not be annealed to maintain physical properties. Carbon flame shall not be used in the annealing process. Damaged waterstops shall be repaired by removing damaged portions and patching. Patches shall overlap a minimum of 1 inch onto undamaged portion of the waterstop.

#### 3.2.2 Flat Steel

Splices in flat steel waterstops shall be properly aligned, butt welded, and cleaned of excessive material.

#### 3.2.3 Non-Metallic

Fittings shall be shop made using a machine specifically designed to mechanically weld the waterstop. A miter guide, proper fixturing (profile

dependant), and portable power saw shall be used to miter cut the ends to be joined to ensure good alignment and contact between joined surfaces. The splicing of straight lengths shall be done by squaring the ends to be joined. Continuity of the characteristic features of the cross section of the waterstop (ribs, tabular center axis, protrusions, etc.) shall be maintained across the splice.

#### 3.2.3.1 Rubber Waterstop

Splices shall be vulcanized or shall be made using cold bond adhesive as recommended by the manufacturer. Splices for TPE-R shall be as specified for PVC.

#### 3.2.3.2 Polyvinyl Chloride Waterstop

Splices shall be made by heat sealing the adjacent waterstop edges together using a thermoplastic splicing iron utilizing a non-stick surface specifically designed for waterstop welding. The correct temperature shall be used to sufficiently melt without charring the plastic. The spliced area, when cooled, shall show no signs of separation, holes, or other imperfections when bent by hand in as sharp an angle as possible.

#### 3.2.3.3 Quality Assurance

Edge welding will not be permitted. Centerbulbs shall be compressed or closed when welding to non-centerbulb type. Waterstop splicing defects which are unacceptable include, but are not limited to the following: 1) Tensile strength less than 80 percent of parent section. 2) Free lap joints. 3) Misalignment of centerbulb, ribs, and end bulbs greater than 1/16 inch. 4) Misalignment which reduces waterstop cross section more than 15 percent. 5) Bond failure at joint deeper than 1/16 inch or 15 percent of material thickness. 6) Misalignment of waterstop splice resulting in misalignment of waterstop in excess of 1/2 inch in 10 feet. 7) Visible porosity in the weld area, including pin holes. 8) Charred or burnt material. 9) Bubbles or inadequate bonding. 10) Visible signs of splice separation when cooled splice is bent by hand at a sharp angle.

#### 3.2.4 Non-Metallic Hydrophilic Waterstop Installation

Ends to be joined shall be miter cut with sharp knife or shears. The ends shall be adhered with cyanacrylate (super glue) adhesive. When joining hydrophilic type waterstop to PVC waterstop, the hydrophilic waterstop shall be positioned as shown on the drawings. A liberal amount of a single component hydrophilic sealant shall be applied to the junction to complete the transition.

#### 3.2.5 Preformed Plastic Adhesive Installation

The installation of preformed plastic adhesive waterstops shall be a prime, peel, place and pour procedure. Joint surfaces shall be clean and dry before priming and just prior to placing the sealing strips. The end of each strip shall be spliced to the next strip with a 1 inch overlap; the overlap shall be pressed firmly to release trapped air. During damp or cold conditions the joint surface shall be flashed with a safe, direct

flame to warm and dry the surface adequately; the sealing strips shall be dipped in warm water to soften the material to achieve maximum bond to the concrete surface.

### 3.3 CONSTRUCTION JOINTS

Construction joints are specified in Section 03300 CAST-IN-PLACE STRUCTURAL CONCRETE except that construction joints coinciding with expansion and contraction joints shall be treated as expansion or contraction joints as applicable.

-- End of Section --

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**09/97**

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SECTION 03200

CONCRETE REINFORCEMENT  
**09/97**

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

|                   |  |
|-------------------|--|
| ASTM A 185        | (1997) Steel Welded Wire Fabric, Plain,<br>for Concrete Reinforcement        |
| ASTM A 497        | (1997) Steel Welded Wire Fabric, Deformed,<br>for Concrete Reinforcement     |
| ASTM A 615/A 615M | (1996a) Deformed and Plain Billet-Steel<br>Bars for Concrete Reinforcement   |
| ASTM A 706/A 706M | (1998) Low-Alloy Steel Deformed and Plain<br>Bars for Concrete Reinforcement |

AMERICAN WELDING SOCIETY (AWS)

|          |   |
|----------|---|
| AWS D1.4 | (1998) Structural Welding Code -<br>Reinforcing Steel |
|----------|---|

CONCRETE REINFORCING STEEL INSTITUTE (CRSI)

|            |                                    |
|------------|------------------------------------|
| CRSI MSP-1 | (1996) Manual of Standard Practice |
|------------|------------------------------------|

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Reinforcement



Detail drawings showing reinforcing steel placement, schedules, sizes, grades, and splicing and bending details. Drawings shall show support details including types, sizes and spacing.

SD-03 Product Data

Welding

A list of qualified welders names.

1.3 OMITTED

1.4 DELIVERY AND STORAGE

Reinforcement and accessories shall be stored off the ground on platforms, skids, or other supports.

PART 2 PRODUCTS

2.1 OMITTED

2.2 FABRICATED BAR MATS

Fabricated bar mats shall conform to ASTM A 184/A 184M.

2.3 REINFORCING STEEL

Reinforcing steel shall be deformed bars conforming to ASTM A 615/A 615M or ASTM A 706/A 706M, grade 60 and sizes as indicated.

2.4 WELDED WIRE FABRIC

Welded wire fabric shall conform to ASTM A 185 or ASTM A 497.

2.5 WIRE TIES

Wire ties shall be 16 gauge or heavier black annealed steel wire.

2.6 SUPPORTS

Bar supports for formed surfaces shall be designed and fabricated in accordance with CRSI MSP-1 and shall be steel or precast concrete blocks. Precast concrete blocks shall have wire ties and shall be not less than 4 inches square when supporting reinforcement on ground. Precast concrete block shall have compressive strength equal to that of the surrounding concrete. Where concrete formed surfaces will be exposed to weather or where surfaces are to be painted, steel supports within 1/2 inch of concrete surface shall be galvanized, plastic protected or of stainless steel. Concrete supports used in concrete exposed to view shall have the same color and texture as the finish surface. For slabs on grade, supports shall be precast concrete blocks, plastic coated steel fabricated with bearing plates, or specifically designed wire-fabric supports fabricated of plastic.

## PART 3 EXECUTION

### 3.1 REINFORCEMENT

Reinforcement shall be fabricated to shapes and dimensions shown and shall conform to the requirements of ACI 318/318R. Reinforcement shall be cold bent unless otherwise authorized. Bending may be accomplished in the field or at the mill. Bars shall not be bent after embedment in concrete. Safety caps shall be placed on all exposed ends of vertical concrete reinforcement bars that pose a danger to life safety. Wire tie ends shall face away from the forms.

#### 3.1.1 Placement

Reinforcement shall be free from loose rust and scale, dirt, oil, or other deleterious coating that could reduce bond with the concrete. Reinforcement shall be placed in accordance with ACI 318/318R at locations shown plus or minus one bar diameter. Reinforcement shall not be continuous through expansion joints and shall be as indicated through construction or contraction joints. Concrete coverage shall be as indicated or as required by ACI 318/318R. If bars are moved more than one bar diameter to avoid interference with other reinforcement, conduits or embedded items, the resulting arrangement of bars, including additional bars required to meet structural requirements, shall be approved before concrete is placed.

#### 3.1.2 Splicing

Splices of reinforcement shall conform to ACI 318/318R and shall be made only as required or indicated. Splicing shall be by lapping or by mechanical connection. Welding shall conform to AWS D1.4. Lapped bars shall be placed in contact and securely tied or spaced transversely apart to permit the embedment of the entire surface of each bar in concrete. Lapped bars shall not be spaced farther apart than either one-fifth the required length of lap or 6 inches. Mechanical butt splices shall be in accordance with the recommendation of the manufacturer of the mechanical splicing device. Butt splices shall develop 125 percent of the specified minimum yield tensile strength of the spliced bars or of the smaller bar in transition splices. Bars shall be flame dried before butt splicing. Adequate jigs and clamps or other devices shall be provided to support, align, and hold the longitudinal centerline of the bars to be butt spliced in a straight line.

### 3.2 WELDED-WIRE FABRIC PLACEMENT

Welded-wire fabric shall be placed in slabs as indicated. Fabric placed in slabs on grade shall be continuous between expansion, construction, and contraction joints. Fabric placement at joints shall be as indicated. Lap splices shall be made in such a way that the overlapped area equals the distance between the outermost crosswires plus 2 inches. Laps shall be staggered to avoid continuous laps in either direction. Fabric shall be wired or clipped together at laps at intervals not to exceed 4 feet. Fabric shall be positioned by the use of supports.

### 3.3 DOWEL INSTALLATION

Dowels shall be installed in slabs on grade at locations indicated and at right angles to joint being doweled. Dowels shall be accurately positioned and aligned parallel to the finished concrete surface before concrete placement. Dowels shall be rigidly supported during concrete placement.

-- End of Section --

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SECTION 03300

CAST-IN-PLACE STRUCTURAL CONCRETE

09/95

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

ACI INTERNATIONAL (ACI)

|              |   |
|--------------|---|
| ACI 117/117R | (1990; Errata) Standard Tolerances for Concrete Construction and Materials                                |
| ACI 211.1    | (1991) Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete             |
| ACI 214.3R   | (1988) Simplified Version of the Recommended Practice for Evaluation of Strength Test Results of Concrete |
| ACI 305R     | (1991) Hot Weather Concreting   |
| ACI 318/318R | (1999) Building Code Requirements for Structural Concrete and Commentary                                  |

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)

|              |   |
|--------------|---|
| AASHTO M 182 | (1991; R 1996) Burlap Cloth Made From Jute or Kenaf |
|--------------|---|

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

|                 |   |
|-----------------|---|
| ASTM C 31/C 31M | (1998) Making and Curing Concrete Test Specimens in the Field |
| ASTM C 33       | (19999a) Concrete Aggregates                                  |
| ASTM C 39       | (1996) Compressive Strength of Cylindrical Concrete Specimens |



|                   |   |
|-------------------|---|
| ASTM C 42         | (1999) Obtaining and Testing Drilled Cores and Sawed Beams of Concrete                              |
| ASTM C 78         | (1994) Flexural Strength of Concrete (Using Simple Beam With Third-Point Loading)                   |
| ASTM C 94         | (1999) Ready-Mixed Concrete   |
| ASTM C 136        | (1996a) Sieve Analysis of Fine and Coarse Aggregates  |
| ASTM C 143        | (1998) Slump of Hydraulic Cement Concrete   |
| ASTM C 150        | (1998a) Portland Cement   |
| ASTM C 171        | (1997a) Sheet Materials for Curing Concrete   |
| ASTM C 172        | (1999) Sampling Freshly Mixed Concrete  |
| ASTM C 173        | (1994ael) Air Content of Freshly Mixed Concrete by the Volumetric Method                            |
| ASTM C 192/C 192M | (1998) Making and Curing Concrete Test Specimens in the Laboratory                                  |
| ASTM C 231        | (1997el) Air Content of Freshly Mixed Concrete by the Pressure Method                               |
| ASTM C 260        | (1998) Air-Entraining Admixtures for Concrete   |
| ASTM C 309        | (1998a) Liquid Membrane-Forming Compounds for Curing Concrete                                       |
| ASTM C 494        | (1999) Chemical Admixtures for Concrete   |
| ASTM C 552        | (1991) Cellular Glass Thermal Insulation  |
| ASTM C 578        | (1995) Rigid, Cellular Polystyrene Thermal Insulation   |
| ASTM C 591        | (1994) Unfaced Preformed Rigid Cellular Polyisocyanurate Thermal Insulation                         |
| ASTM C 618        | (1999) Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Concrete |
| ASTM C 881        | (1999) Epoxy-Resin-Base Bonding Systems for Concrete  |

|                     |   |
|---------------------|---|
| ASTM C 940          | (1998a) Expansion and Bleeding of Freshly Mixed Grouts for Preplaced-Aggregate Concrete in the Laboratory                   |
| ASTM C 1017         | (1998) Chemical Admixtures for Use in Producing Flowing Concrete  |
| ASTM C 1059         | (1999) Latex Agents for Bonding Fresh to Hardened Concrete  |
| ASTM C 1064/C 1064M | (1999) Temperature of Freshly Mixed Portland Cement Concrete  |
| ASTM C 1077         | (1998) Laboratories Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Laboratory Evaluation |
| ASTM C 1107         | (1999) Packaged Dry, Hydraulic-Cement Grout (Nonshrink)   |
| ASTM D 75           | (1987; R 1997) Sampling Aggregates  |
| ASTM E 96           | (1995) Water Vapor Transmission of Materials  |

CORPS OF ENGINEERS (COE)

|               |   |
|---------------|---|
| COE CRD-C 104 | (1980) Method of Calculation of the Fineness Modulus of Aggregate   |
| COE CRD-C 400 | (1963) Requirements for Water for Use in Mixing or Curing Concrete  |
| COE CRD-C 521 | (1981) Standard Test Method for Frequency and Amplitude of Vibrators for Concrete   |
| COE CRD-C 540 | (1971; R 1981) Standard Specification for Nonbituminous Inserts for Contraction Joints in Portland Cement Concrete Airfield Pavements, Sawable Type |

NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY (NIST)

|            |  |
|------------|--|
| NIST HB 44 | (1997) NIST Handbook 44: Specifications, Tolerances, and Other Technical Requirements for Weighing and Measuring Devices |
|------------|--|

NATIONAL READY-MIXED CONCRETE ASSOCIATION (NRMCA)

|                |  |
|----------------|--|
| NRMCA CPMB 100 | (1996) Concrete Plant Standards  |
| NRMCA TMMB 100 | (1994) Truck Mixer Agitator and Front<br>Discharge Concrete Carrier Standards  |
| NRMCA QC 3     | (1984) Quality Control Manual: Section 3,<br>Plant Certifications Checklist:<br>Certification of Ready Mixed Concrete<br>Production Facilities |

1.2 OMITTED

1.3 LUMP SUM CONTRACT

Under this type of contract concrete items will be paid for by lump sum and will not be measured. The work covered by these items consists of furnishing all concrete materials, reinforcement, miscellaneous embedded materials, and equipment, and performing all labor for the forming, manufacture, transporting, placing, finishing, curing, and protection of concrete in these structures.

1.4 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-03 Product Data

Mixture Proportions; G, RE

The results of trial mixture design studies along with a statement giving the maximum nominal coarse aggregate size and the proportions of ingredients that will be used in the manufacture of each strength or class of concrete, at least 14 days prior to commencing concrete placing operations. Aggregate weights shall be based on the saturated surface dry condition. The statement shall be accompanied by test results from an approved independent commercial testing laboratory, showing that mixture design studies have been made with materials proposed for the project and that the proportions selected will produce concrete of the qualities indicated. No substitutions shall be made in the materials used in the mixture design studies without additional tests to show that the quality of the concrete is satisfactory.

SD-04 Samples

Surface Retarder

Sample of surface retarder material with manufacturer's instructions for application in conjunction with air-water cutting.

#### SD-06 Test Reports

##### Testing and Inspection for Contractor Quality Control; G

Certified copies of laboratory test reports, including mill tests and all other test data, for portland cement, blended cement, pozzolan, ground granulated blast furnace slag, silica fume, aggregate, admixtures, and curing compound proposed for use on this project.

#### SD-07 Certificates

##### Qualifications

Written documentation for Contractor Quality Control personnel.

### 1.5 QUALIFICATIONS

Contractor Quality Control personnel assigned to concrete construction shall be American Concrete Institute (ACI) Certified Workmen in one of the following grades or shall have written evidence of having completed similar qualification programs:

Concrete Field Testing Technician, Grade I  
Concrete Laboratory Testing Technician, Grade I or II  
Concrete Construction Inspector, Level II

Concrete Transportation Construction Inspector or  
Reinforced Concrete Special Inspector, Jointly certified by  
American Concrete Institute (ACI), Building Official and Code  
Administrators International (BOCA), International Conference of  
Building Officials (ICBO), and Southern Building Code Congress  
International (SBCCI).

The foreman or lead journeyman of the flatwork finishing crew shall have similar qualification for ACI Concrete Flatwork Technician/Finisher or equal, with written documentation.

1.6 OMITTED

1.7 OMITTED

### 1.8 GENERAL REQUIREMENTS

#### 1.8.1 Tolerances

Except as otherwise specified herein, tolerances for concrete batching, mixture properties, and construction as well as definition of terms and application practices shall be in accordance with ACI 117/117R. Level and grade tolerance measurements of slabs shall be made as soon as possible after finishing; when forms or shoring are used, the measurements shall be made prior to removal.

##### 1.8.1.1 Floors

For the purpose of this Section the following terminology correlation between ACI 117/117R and this Section shall apply:

| Floor Profile Quality<br>Classification From ACI 117/117R<br>----- | This Section<br>-----         |
|--|-------------------------------|
| Conventional Bullfloated   | Same                          |
| Conventional Straightedged   | Same                          |
| Flat   | Float Finish or Trowel Finish |
| Very Flat  | Same.                         |

Levelness tolerance shall not apply where design requires floors to be sloped to drains or sloped for other reasons.

#### 1.8.1.2 Floors by the F-Number System

The flatness and levelness of floors shall be carefully controlled and the tolerances shall be measured by the F-Number system of Paragraph 4.5.6 and 4.5.6.1 of ACI 117/117R. The Contractor shall furnish an approved floor profilograph or other equipment capable of measuring the floor flatness (FF) number and the floor levelness (FL) number in accordance with ASTM E 1155. The Contractor shall perform the tolerance measurements within 72 hours after floor slab construction while being observed by the Contracting Officer. The tolerances of surfaces beyond the limits of ASTM E 1155 (the areas within 24 inches of embedments and construction joints) shall be acceptable to the Contracting Officer. Tolerances of the following areas shall meet the requirements for the listed surfaces as specified in paragraphs 4.5.6 and 4.5.6.1 of ACI 117/117R.

|                |  |
|----------------|--|
| Bullfloated-   | Areas Recessed for Mortar Setting Beds   |
| Float Finish-  | Areas Not Otherwise Noted                |
| Trowel Finish- | Areas Exposed to View in Final Structure |

#### 1.8.2 Strength Requirements and w/c Ratio

##### 1.8.2.1 Strength Requirements

Specified compressive strength (f'c) shall be as follows:

| COMPRESSIVE STRENGTH | STRUCTURE OR PORTION OF STRUCTURE                    |
|----------------------|--|
| 3000 psi at 28 days  | All Volume I (OPS) concrete unless otherwise noted   |
| 4000 psi at 28 days  | All Volume II (Ammo) concrete unless otherwise noted |

Compressive strength shall be determined in accordance with ASTM C 39.

- a. Evaluation of Concrete Compressive Strength. Compressive strength specimens (6 by 12 inch cylinders) shall be fabricated by the Contractor and laboratory cured in accordance with ASTM C 31/C 31M

and tested in accordance with ASTM C 39. The strength of the concrete will be considered satisfactory so long as the average of all sets of three consecutive test results equals or exceeds the specified compressive strength  $f'_c$  and no individual test result falls below the specified strength  $f'_c$  by more than 500 psi. A "test" is defined as the average of two companion cylinders, or if only one cylinder is tested, the results of the single cylinder test. Additional analysis or testing, including taking cores and/or load tests may be required at the Contractor's expense when the strength of the concrete in the structure is considered potentially deficient.

- b. Investigation of Low-Strength Compressive Test Results. When any strength test of standard-cured test cylinders falls below the specified strength requirement by more than 500 psi or if tests of field-cured cylinders indicate deficiencies in protection and curing, steps shall be taken to assure that the load-carrying capacity of the structure is not jeopardized. When the strength of concrete in place is considered potentially deficient, cores shall be obtained and tested in accordance with ASTM C 42. At least three representative cores shall be taken from each member or area of concrete in place that is considered potentially deficient. The location of cores will be determined by the Contracting Officer to least impair the strength of the structure. Concrete in the area represented by the core testing will be considered adequate if the average strength of the cores is equal to at least 85 percent of the specified strength requirement and if no single core is less than 75 percent of the specified strength requirement. Non-destructive tests (tests other than test cylinders or cores) shall not be used as a basis for acceptance or rejection. The Contractor shall perform the coring and repair the holes. Cores will be tested by the Government.
- c. Load Tests. If the core tests are inconclusive or impractical to obtain or if structural analysis does not confirm the safety of the structure, load tests may be directed by the Contracting Officer in accordance with the requirements of ACI 318/318R. Concrete work evaluated by structural analysis or by results of a load test as being understrength shall be corrected in a manner satisfactory to the Contracting Officer. All investigations, testing, load tests, and correction of deficiencies shall be performed by and at the expense of the Contractor and must be approved by the Contracting Officer, except that if all concrete is found to be in compliance with the drawings and specifications, the cost of investigations, testing, and load tests will be at the expense of the Government.

#### 1.8.2.2 Water-Cement Ratio

Maximum water-cement ratio (w/c) for normal weight concrete shall be as follows:

WATER-CEMENT RATIO, BY WEIGHT                      STRUCTURE OR PORTION OF STRUCTURE

|  |   |
|--|---|
| 0.45 All slabs on grade                  | 0 |
| 0.50 All concrete unless noted otherwise | 0 |

These w/c's may cause higher strengths than that required above for compressive or flexural strength. The maximum w/c required will be the equivalent w/c as determined by conversion from the weight ratio of water to cement plus pozzolan, by the weight equivalency method as described in ACI 211.1.

1.8.3 Air Entrainment

Except as otherwise specified all normal weight concrete shall be air entrained to contain between 4 and 7 percent total air, except that when the nominal maximum size coarse aggregate is 3/4 inch or smaller it shall be between 4.5 and 7.5 percent. Specified air content shall be attained at point of placement into the forms. Air content for normal weight concrete shall be determined in accordance with ASTM C 231.

1.8.4 Slump

Slump of the concrete, as delivered to the point of placement into the forms, shall be within the following limits. Slump shall be determined in accordance with ASTM C 143.

| Structural Element   | Minimum | Slump<br>Maximum |
|--|---------|------------------|
| Walls, columns and beams                                   | 2 in.   | 0 in.            |
| Foundation walls, substructure walls, footings, slabs      | 1 in.   | 0 in.            |
| Any structural concrete approved for placement by pumping: |         |                  |
| At pump  | 2 in.   | 0 in.            |
| At discharge of line                                       | 1 in.   | 0 in.            |

When use of a plasticizing admixture conforming to ASTM C 1017 or when a Type F or G high range water reducing admixture conforming to ASTM C 494 is permitted to increase the slump of concrete, concrete shall have a slump of 2 to 4 inches before the admixture is added and a maximum slump of 8 inches at the point of delivery after the admixture is added.

1.8.5 Concrete Temperature

The temperature of the concrete as delivered shall not exceed 90 degrees F. When the ambient temperature during placing is 40 degrees F or less, or

is expected to be at any time within 6 hours after placing, the temperature of the concrete as delivered shall be between 55 and 75 degrees F.

#### 1.8.6 Size of Coarse Aggregate

The largest feasible nominal maximum size aggregate (NMSA) specified in paragraph AGGREGATES shall be used in each placement. However, nominal maximum size of aggregate shall not exceed any of the following: three-fourths of the minimum cover for reinforcing bars, three-fourths of the minimum clear spacing between reinforcing bars, one-fifth of the narrowest dimension between sides of forms, or one-third of the thickness of slabs or toppings.

#### 1.8.7 Special Properties and Products

Concrete may contain admixtures other than air entraining agents, such as water reducers, superplasticizers, or set retarding agents to provide special properties to the concrete, if specified or approved. Any of these materials to be used on the project shall be used in the mix design studies.

### 1.9 MIXTURE PROPORTIONS

Concrete shall be composed of portland cement, other cementitious and pozzolanic materials as specified, aggregates, water and admixtures as specified.

#### 1.9.1 Proportioning Studies for Normal Weight Concrete

Trial design batches, mixture proportioning studies, and testing requirements for various classes and types of concrete specified shall be the responsibility of the Contractor. Mixture proportions shall be based on compressive strength as determined by test specimens fabricated in accordance with ASTM C 192/C 192M and tested in accordance with ASTM C 39. Samples of all materials used in mixture proportioning studies shall be representative of those proposed for use in the project and shall be accompanied by the manufacturer's or producer's test reports indicating compliance with these specifications. Trial mixtures having proportions, consistencies, and air content suitable for the work shall be made based on methodology described in ACI 211.1, using at least three different water-cement ratios for each type of mixture, which will produce a range of strength encompassing those required for each class and type of concrete required on the project. The maximum water-cement ratios required in subparagraph Water-Cement Ratio will be the equivalent water-cement ratio as determined by conversion from the weight ratio of water to cement plus pozzolan, by the weight equivalency method as described in ACI 211.1. If pozzolan is used in the concrete mixture, the minimum pozzolan content shall be 15 percent by weight of the total cementitious material, and the maximum shall be 35 percent. Laboratory trial mixtures shall be designed for maximum permitted slump and air content. Separate sets of trial mixture studies shall be made for each combination of cementitious materials and each combination of admixtures proposed for use. No combination of either shall be used until proven by such studies, except that, if approved in writing and otherwise permitted by these specifications, an accelerator or a retarder may be used without separate



trial mixture study. Separate trial mixture studies shall also be made for concrete for any conveying or placing method proposed which requires special properties and for concrete to be placed in unusually difficult placing locations. The temperature of concrete in each trial batch shall be reported. For each water-cement ratio, at least three test cylinders for each test age shall be made and cured in accordance with ASTM C 192/C 192M. They shall be tested at 7 and 28 days in accordance with ASTM C 39. From these test results, a curve shall be plotted showing the relationship between water-cement ratio and strength for each set of trial mix studies. In addition, a curve shall be plotted showing the relationship between 7 day and 28 day strengths. Each mixture shall be designed to promote easy and suitable concrete placement, consolidation and finishing, and to prevent segregation and excessive bleeding.

1.9.2 Omitted

1.9.3 Omitted

1.9.4 Average Compressive Strength Required for Mixtures

The mixture proportions selected during mixture design studies shall produce a required average compressive strength ( $f'_{cr}$ ) exceeding the specified compressive strength ( $f'_c$ ) by the amount indicated below. This required average compressive strength,  $f'_{cr}$ , will not be a required acceptance criteria during concrete production. However, whenever the daily average compressive strength at 28 days drops below  $f'_{cr}$  during concrete production, or daily average 7-day strength drops below a strength correlated with the 28-day  $f'_{cr}$ , the mixture shall be adjusted, as approved, to bring the daily average back up to  $f'_{cr}$ . During production, the required  $f'_{cr}$  shall be adjusted, as appropriate, based on the standard deviation being attained on the job.

1.9.4.1 Computations from Test Records

Where a concrete production facility has test records, a standard deviation shall be established in accordance with the applicable provisions of ACI 214.3R. Test records from which a standard deviation is calculated shall represent materials, quality control procedures, and conditions similar to those expected; shall represent concrete produced to meet a specified strength or strengths ( $f'_c$ ) within 1,000 psi of that specified for proposed work; and shall consist of at least 30 consecutive tests. A strength test shall be the average of the strengths of two cylinders made from the same sample of concrete and tested at 28 days. Required average compressive strength  $f'_{cr}$  used as the basis for selection of concrete proportions shall be the larger of the equations that follow using the standard deviation as determined above:

$$f'_{cr} = f'_c + 1.34S \text{ where units are in psi}$$

$$f'_{cr} = f'_c + 2.33S - 500 \text{ where units are in psi}$$

Where  $S$  = standard deviation

Where a concrete production facility does not have test records meeting the

requirements above but does have a record based on 15 to 29 consecutive tests, a standard deviation shall be established as the product of the calculated standard deviation and a modification factor from the following table:

| NUMBER OF TESTS | MODIFICATION FACTOR<br>FOR STANDARD DEVIATION |
|-----------------|---|
| 15              | 1.16  |
| 20              | 1.08  |
| 25              | 1.03  |
| 30 or more      | 1.00  |

#### 1.9.4.2 Computations without Previous Test Records

When a concrete production facility does not have sufficient field strength test records for calculation of the standard deviation, the required average strength  $f'_{cr}$  shall be determined as follows:

- a. If the specified compressive strength  $f'_c$  is less than 3,000 psi,  
 $f'_{cr} = f'_c + 1000 \text{ psi}$
- b. If the specified compressive strength  $f'_c$  is 3,000 to 5,000 psi,  
 $f'_{cr} = f'_c + 1,200 \text{ psi}$
- c. If the specified compressive strength  $f'_c$  is over 5,000 psi,  
 $f'_{cr} = f'_c + 1,400 \text{ psi}$

#### 1.10 STORAGE OF MATERIALS

Cement and other cementitious materials shall be stored in weathertight buildings, bins, or silos which will exclude moisture and contaminants and keep each material completely separated. Aggregate stockpiles shall be arranged and used in a manner to avoid excessive segregation and to prevent contamination with other materials or with other sizes of aggregates. Aggregate shall not be stored directly on ground unless a sacrificial layer is left undisturbed. Reinforcing bars and accessories shall be stored above the ground on platforms, skids or other supports. Other materials shall be stored in such a manner as to avoid contamination and deterioration. Admixtures which have been in storage at the project site for longer than 6 months or which have been subjected to freezing shall not be used unless retested and proven to meet the specified requirements. Materials shall be capable of being accurately identified after bundles or containers are opened.

#### 1.11 GOVERNMENT ASSURANCE INSPECTION AND TESTING

Day-to day inspection and testing shall be the responsibility of the Contractor Quality Control (CQC) staff. However, representatives of the Contracting Officer can and will inspect construction as considered appropriate and will monitor operations of the Contractor's CQC staff.

Government inspection or testing will not relieve the Contractor of any of his CQC responsibilities.

#### 1.11.1 Materials

The Government will sample and test aggregates, cementitious materials, other materials, and concrete to determine compliance with the specifications as considered appropriate. The Contractor shall provide facilities and labor as may be necessary for procurement of representative test samples. Samples of aggregates will be obtained at the point of batching in accordance with ASTM D 75. Other materials will be sampled from storage at the jobsite or from other locations as considered appropriate. Samples may be placed in storage for later testing when appropriate.

#### 1.11.2 Fresh Concrete

Fresh concrete will be sampled as delivered in accordance with ASTM C 172 and tested in accordance with these specifications, as considered necessary.

#### 1.11.3 Hardened Concrete

Tests on hardened concrete will be performed by the Government when such tests are considered necessary.

#### 1.11.4 Inspection

Concrete operations may be tested and inspected by the Government as the project progresses. Failure to detect defective work or material will not prevent rejection later when a defect is discovered nor will it obligate the Government for final acceptance.

### PART 2 PRODUCTS

#### 2.1 CEMENTITIOUS MATERIALS

Cementitious Materials shall be portland cement, or portland cement in combination with pozzolan and shall conform to appropriate specifications listed below. Use of cementitious materials in concrete which will have surfaces exposed in the completed structure shall be restricted so there is no change in color, source, or type of cementitious material.

##### 2.1.1 Portland Cement

ASTM C 150, Type I low alkali with a maximum 15 percent amount of tricalcium aluminate, or Type II low alkali including false set requirements or Type V. White portland cement shall meet the above requirements except that it may be Type I, Type II or Type III low alkali. White Type III shall be used only in specific areas of the structure, when approved in writing.

##### 2.1.2 Omitted

##### 2.1.3 Omitted

#### 2.1.4 Pozzolan (Fly Ash)

ASTM C 618, Class F with the optional requirements for multiple factor, drying shrinkage, and uniformity from Table 2A of ASTM C 618. Requirement for maximum alkalies from Table 1A of ASTM C 618 shall apply. If pozzolan is used, it shall never be less than 15 percent nor more than 35 percent by weight of the total cementitious material.

### 2.2 AGGREGATES

Aggregates shall conform to the following.

#### 2.2.1 Fine Aggregate

Fine aggregate shall conform to the quality and gradation requirements of ASTM C 33.

#### 2.2.2 Coarse Aggregate

Coarse aggregate shall conform to ASTM C 33, Class 5S, size designation 57.

### 2.3 CHEMICAL ADMIXTURES

Chemical admixtures, when required or permitted, shall conform to the appropriate specification listed. Admixtures shall be furnished in liquid form and of suitable concentration for easy, accurate control of dispensing.

#### 2.3.1 Air-Entraining Admixture

ASTM C 260 and shall consistently entrain the air content in the specified ranges under field conditions.

#### 2.3.2 Accelerating Admixture

ASTM C 494, Type C or E, except that calcium chloride or admixtures containing calcium chloride shall not be used.

#### 2.3.3 Water-Reducing or Retarding Admixture

ASTM C 494, Type A, B, or D, except that the 6-month and 1-year compressive and flexural strength tests are waived.

#### 2.3.4 High-Range Water Reducer

ASTM C 494, Type F or G, except that the 6-month and 1-year strength requirements are waived. The admixture shall be used only when approved in writing, such approval being contingent upon particular mixture control as described in the Contractor's Quality Control Plan and upon performance of separate mixture design studies.

#### 2.3.5 Omitted

#### 2.3.6 Omitted

#### 2.3.7 Other Chemical Admixtures

Chemical admixtures for use in producing flowing concrete shall comply with ASTM C 1017, Type I or II. These admixtures shall be used only when approved in writing, such approval being contingent upon particular mixture control as described in the Contractor's Quality Control Plan and upon performance of separate mixture design studies.

#### 2.4 CURING MATERIALS

##### 2.4.1 Impervious-Sheet

Impervious-sheet materials shall conform to ASTM C 171, type optional, except, that polyethylene sheet shall not be used.

##### 2.4.2 Membrane-Forming Compound

Membrane-Forming curing compound shall conform to ASTM C 309, Type 1-D or 2, except that only a styrene acrylate or chlorinated rubber compound meeting Class B requirements shall be used for surfaces that are to be painted or are to receive bituminous roofing, or waterproofing, or floors that are to receive adhesive applications of resilient flooring. The curing compound selected shall be compatible with any subsequent paint, roofing, waterproofing, or flooring specified. Nonpigmented compound shall contain a fugitive dye, and shall have the reflective requirements in ASTM C 309 waived.

##### 2.4.3 Burlap and Cotton Mat

Burlap and cotton mat used for curing shall conform to AASHTO M 182.

#### 2.5 WATER

Water for mixing and curing shall be fresh, clean, potable, and free of injurious amounts of oil, acid, salt, or alkali, except that non-potable water may be used if it meets the requirements of COE CRD-C 400.

#### 2.6 NONSHRINK GROUT

Nonshrink grout shall conform to ASTM C 1107, Grade B, and shall be a commercial non-metallic formulation suitable for the proposed application.

#### 2.7 NONSLIP SURFACING MATERIAL

Nonslip surfacing material shall consist of 55 percent, minimum, aluminum oxide or silicon-dioxide abrasive ceramically bonded together to form a homogeneous material sufficiently porous to provide a good bond with portland cement paste; or factory-graded emery aggregate consisting of not less than 45 percent aluminum oxide and 25 percent ferric oxide. The aggregate shall be well graded from particles retained on the No. 30 sieve to particles passing the No. 8 sieve.

#### 2.8 LATEX BONDING AGENT

Latex agents for bonding fresh to hardened concrete shall conform to ASTM C 1059.

## 2.9 EPOXY RESIN

Epoxy resins for use in repairs shall conform to ASTM C 881, Type V, Grade 2. Class as appropriate to the existing ambient and surface temperatures.

## 2.10 EMBEDDED ITEMS

Embedded items shall be of the size and type indicated or as needed for the application. Dovetail slots shall be galvanized steel. Hangers for suspended ceilings shall be as specified in Section 09510 ACOUSTICAL CEILINGS. Inserts for shelf angles and bolt hangers shall be as indicated on drawings.

## 2.11 FLOOR HARDENER

Floor hardener shall be a colorless aqueous solution containing zinc silicofluoride, magnesium silicofluoride, or sodium silicofluoride. These silicofluorides can be used individually or in combination. Proprietary hardeners may be used if approved in writing by the Contracting Officer.

## 2.12 PERIMETER INSULATION

Perimeter insulation shall be polystyrene conforming to ASTM C 578, Type II; polyurethane conforming to ASTM C 591, Type II; or cellular glass conforming to ASTM C 552, Type I or IV.

## 2.13 VAPOR BARRIER

Vapor barrier shall be polyethylene sheeting with a minimum thickness of 6 mils or other equivalent material having a vapor permeance rating not exceeding 0.5 perms as determined in accordance with ASTM E 96.

## 2.14 JOINT MATERIALS

### 2.14.1 Joint Fillers, Sealers, and Waterstops

Expansion joint fillers and materials for waterstops shall be in accordance with Section 03150 EXPANSION JOINTS, CONTRACTION JOINTS, AND WATERSTOPS. Materials for and sealing of joints shall conform to the requirements of Section 07900 JOINT SEALING.

### 2.14.2 Contraction Joints in Slabs

Sawable type contraction joint inserts shall conform to COE CRD-C 540.

## PART 3 EXECUTION

### 3.1 PREPARATION FOR PLACING

Before commencing concrete placement, the following shall be performed.

Surfaces to receive concrete shall be clean and free from frost, ice, mud, and water. Forms shall be in place, cleaned, coated, and adequately supported, in accordance with Section 03100 STRUCTURAL CONCRETE FORMWORK. Reinforcing steel shall be in place, cleaned, tied, and adequately supported, in accordance with Section 03200 CONCRETE REINFORCEMENT. Transporting and conveying equipment shall be in-place, ready for use, clean, and free of hardened concrete and foreign material. Equipment for consolidating concrete shall be at the placing site and in proper working order. Equipment and material for curing and for protecting concrete from weather or mechanical damage shall be at the placing site, in proper working condition and in sufficient amount for the entire placement. When hot, windy conditions during concreting appear probable, equipment and material shall be at the placing site to provide windbreaks, shading, fogging, or other action to prevent plastic shrinkage cracking or other damaging drying of the concrete.

### 3.1.1 Foundations

#### 3.1.1.1 Concrete on Earth Foundations

Earth (subgrade, base, or subbase courses) surfaces upon which concrete is to be placed shall be clean, damp, and free from debris, frost, ice, and standing or running water. Prior to placement of concrete, the foundation shall be well drained and shall be satisfactorily graded and uniformly compacted.

#### 3.1.1.2 Preparation of Rock

Rock surfaces upon which concrete is to be placed shall be free from oil, standing or running water, ice, mud, drummy rock, coating, debris, and loose, semidetached or unsound fragments. Joints in rock shall be cleaned to a satisfactory depth, as determined by the Contracting Officer, and to firm rock on the sides. Immediately before the concrete is placed, rock surfaces shall be cleaned thoroughly by the use of air-water jets or sandblasting as specified below for Previously Placed Concrete. Rock surfaces shall be kept continuously moist for at least 24 hours immediately prior to placing concrete thereon. All horizontal and approximately horizontal surfaces shall be covered, immediately before the concrete is placed, with a layer of mortar proportioned similar to that in the concrete mixture. Concrete shall be placed before the mortar stiffens.

#### 3.1.1.3 Excavated Surfaces in Lieu of Forms

Concrete for footings may be placed directly against the soil provided the earth or rock has been carefully trimmed, is uniform and stable, and meets the compaction requirements of Section 02315 EXCAVATION, FILLING, AND BACKFILLING FOR BUILDINGS. The concrete shall be placed without becoming contaminated by loose material, and the outline of the concrete shall be within the specified tolerances.

### 3.1.2 Previously Placed Concrete

#### 3.1.2.1 Omitted

#### 3.1.2.2 Omitted

3.1.2.3 Omitted

3.1.2.4 Omitted

#### 3.1.2.5 Preparation of Previously Placed Concrete

Concrete surfaces to which other concrete is to be bonded shall be abraded in an approved manner that will expose sound aggregate uniformly without damaging the concrete. Laitance and loose particles shall be removed. Surfaces shall be thoroughly washed and shall be moist but without free water when concrete is placed.

#### 3.1.3 Vapor Barrier

Vapor barrier shall be provided beneath the interior on-grade concrete floor slabs. The greatest widths and lengths practicable shall be used to eliminate joints wherever possible. Joints shall be lapped a minimum of 12 inches. Torn, punctured, or damaged vapor barrier material shall be removed and new vapor barrier shall be provided prior to placing concrete. For minor repairs, patches may be made using laps of at least 12 inches. Lapped joints shall be sealed and edges patched with pressure-sensitive adhesive or tape not less than 2 inches wide and compatible with the membrane. Vapor barrier shall be placed directly on underlying subgrade, base course, or capillary water barrier, unless it consists of crushed material or large granular material which could puncture the vapor barrier.

In this case, the surface shall be choked with a light layer of sand, as approved, before placing the vapor barrier. A 2 inch layer of compacted, clean concrete sand (fine aggregate) shall be placed on top of the vapor barrier before placing concrete. Concrete placement shall be controlled so as to prevent damage to the vapor barrier, or any covering sand.

#### 3.1.4 Perimeter Insulation

Perimeter insulation shall be installed at locations indicated. Adhesive shall be used where insulation is applied to the interior surface of foundation walls and may be used for exterior application.

#### 3.1.5 Embedded Items

Before placement of concrete, care shall be taken to determine that all embedded items are firmly and securely fastened in place as indicated on the drawings, or required. Conduit and other embedded items shall be clean and free of oil and other foreign matter such as loose coatings or rust, paint, and scale. The embedding of wood in concrete will be permitted only when specifically authorized or directed. The embedding of aluminum in concrete is prohibited. Voids in sleeves, inserts, and anchor slots shall be filled temporarily with readily removable materials to prevent the entry of concrete into voids. Welding shall not be performed on embedded metals within 1 foot of the surface of the concrete, except as indicated. Tack welding shall not be performed on or to embedded items.

### 3.2 CONCRETE PRODUCTION

#### 3.2.1 Batching, Mixing, and Transporting Concrete



Concrete shall either be batched and mixed onsite or shall be furnished from a ready-mixed concrete plant. Ready-mixed concrete shall be batched, mixed, and transported in accordance with ASTM C 94, except as otherwise specified. Truck mixers, agitators, and nonagitating transporting units shall comply with NRMCA TMMB 100. Ready-mix plant equipment and facilities shall be certified in accordance with NRMCA QC 3. Approved batch tickets shall be furnished for each load of ready-mixed concrete. Site-mixed concrete shall conform to the following subparagraphs.

#### 3.2.1.1 General

The batching plant shall be located off site close to the project. The batching plant shall conform to the requirements of NRMCA CPMB 100 and as specified; however, rating plates attached to batch plant equipment are not required.

#### 3.2.1.2 Batching Equipment

The batching controls shall be semiautomatic or automatic, as defined in NRMCA CPMB 100. A semiautomatic batching system shall be provided with interlocks such that the discharge device cannot be actuated until the indicated material is within the applicable tolerance. The batching system shall be equipped with accurate recorder or recorders that meet the requirements of NRMCA CPMB 100. The weight of water and admixtures shall be recorded if batched by weight. Separate bins or compartments shall be provided for each size group of aggregate and type of cementitious material, to prevent intermingling at any time. Aggregates shall be weighed either in separate weigh batchers with individual scales or, provided the smallest size is batched first, cumulatively in one weigh batcher on one scale. Aggregate shall not be weighed in the same batcher with cementitious material. If both portland cement and other cementitious material are used, they may be batched cumulatively, provided that the portland cement is batched first. Water may be measured by weight or volume. Water shall not be weighed or measured cumulatively with another ingredient. Filling and discharging valves for the water metering or batching system shall be so interlocked that the discharge valve cannot be opened before the filling valve is fully closed. Piping for water and for admixtures shall be free from leaks and shall be properly valved to prevent backflow or siphoning. Admixtures shall be furnished as a liquid of suitable concentration for easy control of dispensing. An adjustable, accurate, mechanical device for measuring and dispensing each admixture shall be provided. Each admixture dispenser shall be interlocked with the batching and discharging operation of the water so that each admixture is separately batched and individually discharged automatically in a manner to obtain uniform distribution throughout the water as it is added to the batch in the specified mixing period. When use of truck mixers makes this requirement impractical, the admixture dispensers shall be interlocked with the sand batchers. Different admixtures shall not be combined prior to introduction in water and shall not be allowed to intermingle until in contact with the cement. Admixture dispensers shall have suitable devices to detect and indicate flow during dispensing or have a means for visual observation. The plant shall be arranged so as to facilitate the inspection of all operations at all times. Suitable facilities shall be provided for obtaining representative samples of aggregates from each bin

or compartment, and for sampling and calibrating the dispensing of cementitious material, water, and admixtures. Filling ports for cementitious materials bins or silos shall be clearly marked with a permanent sign stating the contents.

#### 3.2.1.3 Scales

The weighing equipment shall conform to the applicable requirements of CPMB Concrete Plant Standard, and of NIST HB 44, except that the accuracy shall be plus or minus 0.2 percent of scale capacity. The Contractor shall provide standard test weights and any other auxiliary equipment required for checking the operating performance of each scale or other measuring devices. The tests shall be made at the specified frequency in the presence of a Government inspector. The weighing equipment shall be arranged so that the plant operator can conveniently observe all dials or indicators.

#### 3.2.1.4 Batching Tolerances

##### (A) Tolerances with Weighing Equipment

| MATERIAL               | PERCENT OF REQUIRED<br>WEIGHT |
|------------------------|-------------------------------|
| Cementitious materials | 0 to plus 2                   |
| Aggregate              | plus or minus 2               |
| Water                  | plus or minus 1               |
| Chemical admixture     | 0 to plus 6                   |

##### (B) Tolerances with Volumetric Equipment

For volumetric batching equipment used for water and admixtures, the following tolerances shall apply to the required volume of material being batched:

| MATERIAL             | PERCENT OF REQUIRED<br>MATERIAL |
|----------------------|---------------------------------|
| Water:               | plus or minus 1 percent         |
| Chemical admixtures: | 0 to plus 6 percent             |

#### 3.2.1.5 Moisture Control

The plant shall be capable of ready adjustment to compensate for the varying moisture content of the aggregates and to change the weights of the materials being batched.

#### 3.2.1.6 Concrete Mixers

Mixers shall be stationary mixers or truck mixers. Mixers shall be capable of combining the materials into a uniform mixture and of discharging this mixture without segregation. The mixers shall not be charged in excess of

the capacity recommended by the manufacturer. The mixers shall be operated at the drum or mixing blade speed designated by the manufacturer. The mixers shall be maintained in satisfactory operating condition, and the mixer drums shall be kept free of hardened concrete. Should any mixer at any time produce unsatisfactory results, its use shall be promptly discontinued until it is repaired.

#### 3.2.1.7 Stationary Mixers

Concrete plant mixers shall be drum-type mixers of tilting, nontilting, horizontal-shaft, or vertical-shaft type, or shall be pug mill type and shall be provided with an acceptable device to lock the discharge mechanism until the required mixing time has elapsed. The mixing time and uniformity shall conform to all the requirements in ASTM C 94 applicable to central-mixed concrete.

#### 3.2.1.8 Truck Mixers

Truck mixers, the mixing of concrete therein, and concrete uniformity shall conform to the requirements of ASTM C 94. A truck mixer may be used either for complete mixing (transit-mixed) or to finish the partial mixing done in a stationary mixer (shrink-mixed). Each truck shall be equipped with two counters from which it is possible to determine the number of revolutions at mixing speed and the number of revolutions at agitating speed. Water shall not be added at the placing site unless specifically approved; and in no case shall it exceed the specified w/c. Any such water shall be injected at the base of the mixer, not at the discharge end.

3.3 OMITTED

3.4 OMITTED

3.5 OMITTED

#### 3.6 TRANSPORTING CONCRETE TO PROJECT SITE

Concrete shall be transported to the placing site in truck mixers, or by approved pumping equipment. Nonagitating equipment, other than pumps, shall not be used for transporting lightweight aggregate concrete.

#### 3.7 CONVEYING CONCRETE ON SITE

Concrete shall be conveyed from mixer or transporting unit to forms as rapidly as possible and within the time interval specified by methods which will prevent segregation or loss of ingredients using following equipment. Conveying equipment shall be cleaned before each placement.

##### 3.7.1 Buckets

The interior hopper slope shall be not less than 58 degrees from the horizontal, the minimum dimension of the clear gate opening shall be at least 5 times the nominal maximum-size aggregate, and the area of the gate opening shall not be less than 2 square feet. The maximum dimension of the gate opening shall not be greater than twice the minimum dimension. The bucket gates shall be essentially grout tight when closed and may be

manually, pneumatically, or hydraulically operated except that buckets larger than 2 cubic yards shall not be manually operated. The design of the bucket shall provide means for positive regulation of the amount and rate of deposit of concrete in each dumping position.

3.7.2 Omitted

3.7.3 Trucks

Truck mixers operating at agitating speed or truck agitators used for transporting plant-mixed concrete shall conform to the requirements of ASTM C 94. Nonagitating equipment shall be used only for transporting plant-mixed concrete over a smooth road and when the hauling time is less than 15 minutes. Bodies of nonagitating equipment shall be smooth, watertight, metal containers specifically designed to transport concrete, shaped with rounded corners to minimize segregation, and equipped with gates that will permit positive control of the discharge of the concrete.

3.7.4 Chutes

When concrete can be placed directly from a truck mixer, agitator, or nonagitating equipment, the chutes normally attached to this equipment by the manufacturer may be used. A discharge deflector shall be used when required by the Contracting Officer. Separate chutes and other similar equipment will not be permitted for conveying concrete.

3.7.5 Omitted

3.7.6 Concrete Pumps

Concrete may be conveyed by positive displacement pump when approved. The pumping equipment shall be piston or squeeze pressure type; pneumatic placing equipment shall not be used. The pipeline shall be rigid steel pipe or heavy-duty flexible hose. The inside diameter of the pipe shall be at least 3 times the nominal maximum-size coarse aggregate in the concrete mixture to be pumped but not less than 4 inches. Aluminum pipe shall not be used.

3.8 PLACING CONCRETE

Mixed concrete shall be discharged within 1-1/2 hours or before the mixer drum has revolved 300 revolutions, whichever comes first after the introduction of the mixing water to the cement and aggregates. When the concrete temperature exceeds 85 degrees F, the time shall be reduced to 45 minutes. Concrete shall be placed within 15 minutes after it has been discharged from the transporting unit. Concrete shall be handled from mixer or transporting unit to forms in a continuous manner until the approved unit of operation is completed. Adequate scaffolding, ramps and walkways shall be provided so that personnel and equipment are not supported by in-place reinforcement. Placing will not be permitted when the sun, heat, wind, or limitations of facilities furnished by the Contractor prevent proper consolidation, finishing and curing. Sufficient placing capacity shall be provided so that concrete can be kept free of cold joints.

### 3.8.1 Depositing Concrete

Concrete shall be deposited as close as possible to its final position in the forms, and there shall be no vertical drop greater than 5 feet except where suitable equipment is provided to prevent segregation and where specifically authorized. Depositing of the concrete shall be so regulated that it will be effectively consolidated in horizontal layers not more than 12 inches thick, except that all slabs shall be placed in a single layer. Concrete to receive other construction shall be screeded to the proper level. Concrete shall be deposited continuously in one layer or in layers so that fresh concrete is deposited on in-place concrete that is still plastic. Fresh concrete shall not be deposited on concrete that has hardened sufficiently to cause formation of seams or planes of weakness within the section. Concrete that has surface dried, partially hardened, or contains foreign material shall not be used. When temporary spreaders are used in the forms, the spreaders shall be removed as their service becomes unnecessary. Concrete shall not be placed in slabs over columns and walls until concrete in columns and walls has been in-place at least two hours or until the concrete begins to lose its plasticity. Concrete for beams, girders, brackets, column capitals, haunches, and drop panels shall be placed at the same time as concrete for adjoining slabs.

### 3.8.2 Consolidation

Immediately after placing, each layer of concrete shall be consolidated by internal vibrators, except for slabs 4 inches thick or less. The vibrators shall at all times be adequate in effectiveness and number to properly consolidate the concrete; a spare vibrator shall be kept at the jobsite during all concrete placing operations. The vibrators shall have a frequency of not less than 10,000 vibrations per minute, an amplitude of at least 0.025 inch, and the head diameter shall be appropriate for the structural member and the concrete mixture being placed. Vibrators shall be inserted vertically at uniform spacing over the area of placement. The distance between insertions shall be approximately 1-1/2 times the radius of action of the vibrator so that the area being vibrated will overlap the adjacent just-vibrated area by a reasonable amount. The vibrator shall penetrate rapidly to the bottom of the layer and at least 6 inches into the preceding layer if there is such. Vibrator shall be held stationary until the concrete is consolidated and then vertically withdrawn slowly while operating. Form vibrators shall not be used unless specifically approved and unless forms are constructed to withstand their use. Vibrators shall not be used to move concrete within the forms. Slabs 4 inches and less in thickness shall be consolidated by properly designed vibrating screeds or other approved technique. Excessive vibration of lightweight concrete resulting in segregation or flotation of coarse aggregate shall be prevented. Frequency and amplitude of vibrators shall be determined in accordance with COE CRD-C 521. Grate tampers ("jitterbugs") shall not be used.

### 3.8.3 Cold Weather Requirements

Special protection measures, approved by the Contracting Officer, shall be used if freezing temperatures are anticipated before the expiration of the specified curing period. The ambient temperature of the air where concrete

is to be placed and the temperature of surfaces to receive concrete shall be not less than 40 degrees F. The temperature of the concrete when placed shall be not less than 50 degrees F nor more than 75 degrees F. Heating of the mixing water or aggregates will be required to regulate the concrete placing temperature. Materials entering the mixer shall be free from ice, snow, or frozen lumps. Salt, chemicals or other materials shall not be incorporated in the concrete to prevent freezing. Upon written approval, an accelerating admixture conforming to ASTM C 494, Type C or E may be used, provided it contains no calcium chloride. Calcium chloride shall not be used.

#### 3.8.4 Hot Weather Requirements

When the ambient temperature during concrete placing is expected to exceed 85 degrees F, the concrete shall be placed and finished with procedures previously submitted and as specified herein. The concrete temperature at time of delivery to the forms shall not exceed the temperature shown in the table below when measured in accordance with ASTM C 1064/C 1064M. Cooling of the mixing water or aggregates or placing concrete in the cooler part of the day may be required to obtain an adequate placing temperature. A retarder may be used, as approved, to facilitate placing and finishing. Steel forms and reinforcements shall be cooled as approved prior to concrete placement when steel temperatures are greater than 120 degrees F. Conveying and placing equipment shall be cooled if necessary to maintain proper concrete-placing temperature.

##### Maximum Allowable Concrete Placing Temperature

| Relative Humidity, Percent,<br>During Time of<br>Concrete Placement | Maximum Allowable Concrete<br>Temperature<br>Degrees |
|---|--|
| Greater than 60   | 90 F   |
| 40-60   | 85 F   |
| Less than 40  | 80 F   |

#### 3.8.5 Prevention of Plastic Shrinkage Cracking

During hot weather with low humidity, and particularly with appreciable wind, as well as interior placements when space heaters produce low humidity, the Contractor shall be alert to the tendency for plastic shrinkage cracks to develop and shall institute measures to prevent this. Particular care shall be taken if plastic shrinkage cracking is potentially imminent and especially if it has developed during a previous placement. Periods of high potential for plastic shrinkage cracking can be anticipated by use of Fig. 2.1.5 of ACI 305R. In addition the concrete placement shall be further protected by erecting shades and windbreaks and by applying fog sprays of water, sprinkling, ponding or wet covering. Plastic shrinkage cracks that occur shall be filled by injection of epoxy resin as directed, after the concrete hardens. Plastic shrinkage cracks shall never be troweled over or filled with slurry.

3.8.6 Omitted

3.8.7 Placing Concrete in Congested Areas

Special care shall be used to ensure complete filling of the forms, elimination of all voids, and complete consolidation of the concrete when placing concrete in areas congested with reinforcing bars, embedded items, waterstops and other tight spacing. An appropriate concrete mixture shall be used, and the nominal maximum size of aggregate (NMSA) shall meet the specified criteria when evaluated for the congested area. Vibrators with heads of a size appropriate for the clearances available shall be used, and the consolidation operation shall be closely supervised to ensure complete and thorough consolidation at all points. Where necessary, splices of reinforcing bars shall be alternated to reduce congestion. Where two mats of closely spaced reinforcing are required, the bars in each mat shall be placed in matching alignment to reduce congestion. Reinforcing bars may be temporarily crowded to one side during concrete placement provided they are returned to exact required location before concrete placement and consolidation are completed.

3.8.8 Placing Flowable Concrete

If a plasticizing admixture conforming to ASTM C 1017 is used or if a Type F or G high range water reducing admixture is permitted to increase the slump, the concrete shall meet all requirements of paragraph GENERAL REQUIREMENTS in PART 1. Extreme care shall be used in conveying and placing the concrete to avoid segregation. Consolidation and finishing shall meet all requirements of paragraphs Placing Concrete, Finishing Formed Surfaces, and Finishing Unformed Surfaces. No relaxation of requirements to accommodate flowable concrete will be permitted.

3.9 JOINTS

Joints shall be located and constructed as indicated or approved. Joints not indicated on the drawings shall be located and constructed to minimize the impact on the strength of the structure. In general, such joints shall be located near the middle of the spans of supported slabs, beams, and girders unless a beam intersects a girder at this point, in which case the joint in the girder shall be offset a distance equal to twice the width of the beam. Joints in walls and columns shall be at the underside of floors, slabs, beams, or girders and at the tops of footings or floor slabs, unless otherwise approved. Joints shall be perpendicular to the main reinforcement. All reinforcement shall be continued across joints; except that reinforcement or other fixed metal items shall not be continuous through expansion joints, or through construction or contraction joints in slabs on grade. Reinforcement shall be 2 inches clear from each joint. Except where otherwise indicated, construction joints between interior slabs on grade and vertical surfaces shall consist of 1/2 inch pre-moulded expansion joint material conforming to Section 03150 EXPANSION JOINTS, CONTRACTION JOINTS AND WATERSTOPS. The perimeters of the slabs shall be free of fins, rough edges, spalling, or other unsightly appearance. Reservoir for sealant for construction and contraction joints in slabs shall be formed to the dimensions shown on the drawings by removing snap-out joint-forming inserts, by sawing sawable inserts, or by sawing to

widen the top portion of sawed joints. Joints to be sealed shall be cleaned and sealed as indicated and in accordance with Section 07900 JOINT SEALING.

#### 3.9.1 Construction Joints

Concrete shall be placed continuously so that each unit is monolithic in construction. Fresh concrete shall not be placed against adjacent hardened concrete until it is at least 24 hours old. Construction joints shall be located as indicated or approved. Where concrete work is interrupted by weather, end of work shift or other similar type of delay, location and type of construction joint shall be subject to approval of the Contracting Officer. Unless otherwise indicated and except for slabs on grade, reinforcing steel shall extend through construction joints. Construction joints in slabs on grade shall be keyed or doweled as shown. Concrete columns, walls, or piers shall be in place at least 2 hours, or until the concrete begins to lose its plasticity, before placing concrete for beams, girders, or slabs thereon. In walls having door or window openings, lifts shall terminate at the top and bottom of the opening. Other lifts shall terminate at such levels as to conform to structural requirements or architectural details. Where horizontal construction joints in walls or columns are required, a strip of 1 inch-square-edge lumber, bevelled and oiled to facilitate removal, shall be tacked to the inside of the forms at the construction joint. Concrete shall be placed to a point 1 inch above the underside of the strip. The strip shall be removed 1 hour after the concrete has been placed, and any irregularities in the joint line shall be leveled off with a wood float, and all laitance shall be removed. Prior to placing additional concrete, horizontal construction joints shall be prepared as specified in paragraph Previously Placed Concrete.

#### 3.9.2 Contraction Joints in Slabs on Grade

Contraction joints shall be located and detailed as shown on the drawings. Contraction Joints shall be produced by forming a weakened plane in the concrete slab by sawing a continuous slot with a concrete saw. Regardless of method used to produce the weakened plane, it shall be 1/4 the depth of the slab thickness and between 1/8 and 3/16 inch wide. For saw-cut joints, cutting shall be timed properly with the set of the concrete. Cutting shall be started as soon as the concrete has hardened sufficiently to prevent ravelling of the edges of the saw cut. Cutting shall be completed before shrinkage stresses become sufficient to produce cracking; and no later than 8 hours after placement of concrete. Reservoir for joint sealant shall be formed as previously specified.

#### 3.9.3 Expansion Joints

Installation of expansion joints and sealing of these joints shall conform to the requirements of Section 03150 EXPANSION JOINTS, CONTRACTION JOINTS, AND WATERSTOPS and Section 07900 JOINT SEALING.

#### 3.9.4 Waterstops

Waterstops shall be installed in conformance with the locations and details shown on the drawings using materials and procedures specified in Section



03150 EXPANSION JOINTS, CONTRACTION JOINTS, AND WATERSTOPS.

### 3.9.5 Dowels and Tie Bars

Dowels and tie bars shall be installed at the locations shown on the drawings and to the details shown, using materials and procedures specified in Section 03200 CONCRETE REINFORCEMENT and herein. "Structural" type deformed bar dowels, or tie bars, shall be installed to meet the specified tolerances. Care shall be taken during placing adjacent to and around dowels and tie bars to ensure there is no displacement of the dowel or tie bar and that the concrete completely embeds the dowel or tie bar and is thoroughly consolidated.

### 3.10 FINISHING FORMED SURFACES

Forms, form materials, and form construction are specified in Section 03100 STRUCTURAL CONCRETE FORMWORK. Finishing of formed surfaces shall be as specified herein. Unless another type of architectural or special finish is specified, surfaces shall be left with the texture imparted by the forms except that defective surfaces shall be repaired. Unless painting of surfaces is required, uniform color of the concrete shall be maintained by use of only one mixture without changes in materials or proportions for any structure or portion of structure that requires a Class A or B finish. Except for major defects, as defined hereinafter, surface defects shall be repaired as specified herein within 24 hours after forms are removed. Repairs of the so-called "plaster-type" will not be permitted in any location. Tolerances of formed surfaces shall conform to the requirements of ACI 117/117R. These tolerances apply to the finished concrete surface, not to the forms themselves; forms shall be set true to line and grade. Form tie holes requiring repair and other defects whose depth is at least as great as their surface diameter shall be repaired as specified in paragraph Damp-Pack Mortar Repair. Defects whose surface diameter is greater than their depth shall be repaired as specified in paragraph Repair of Major Defects. Repairs shall be finished flush with adjacent surfaces and with the same surface texture. The cement used for all repairs shall be a blend of job cement with white cement proportioned so that the final color after curing and aging will be the same as the adjacent concrete. Concrete with excessive honeycomb, or other defects which affect the strength of the member, will be rejected. Repairs shall be demonstrated to be acceptable and free from cracks or loose or drummy areas at the completion of the contract and, for Class A and B Finishes, shall be inconspicuous. Repairs not meeting these requirements will be rejected and shall be replaced.

#### 3.10.1 Class B Finish

Class B finish is required for all formed surfaces which are exposed or painted in the finished structure. Fins, ravelings, and loose material shall be removed, all surface defects over 1/2 inch in diameter or more than 1/2 inch deep, shall be repaired and, except as otherwise indicated or as specified in Section 03100 STRUCTURAL CONCRETE FORMWORK, holes left by removal of form ties shall be reamed and filled. Defects more than 1/2 inch in diameter shall be cut back to sound concrete, but in all cases at least 1 inch deep.

### 3.10.2 Class C

Class C finish is required for formed surfaces which are not exposed or painted in the finished structure. Fins, ravelings, and loose material shall be removed, and, except as otherwise indicated or as specified in Section 03100 STRUCTURAL CONCRETE FORMWORK, holes left by removal of form ties shall be reamed and filled. Honeycomb and other defects more than 1/2 inch deep or more than 2 inches in diameter shall be repaired. Defects more than 2 inches in diameter shall be cut back to sound concrete, but in all cases at least 1 inch deep.

### 3.11 REPAIRS

#### 3.11.1 Damp-Pack Mortar Repair

Form tie holes requiring repair and other defects whose depth is at least as great as their surface diameter but not over 4 inches shall be repaired by the damp-pack mortar method. Form tie holes shall be reamed and other similar defects shall be cut out to sound concrete. The void shall then be thoroughly cleaned, thoroughly wetted, brush-coated with a thin coat of neat cement grout and filled with mortar. Mortar shall be a stiff mix of 1 part portland cement to 2 parts fine aggregate passing the No. 16 mesh sieve, and minimum amount of water. Only sufficient water shall be used to produce a mortar which, when used, will stick together on being molded into a ball by a slight pressure of the hands and will not exude water but will leave the hands damp. Mortar shall be mixed and allowed to stand for 30 to 45 minutes before use with remixing performed immediately prior to use. Mortar shall be thoroughly tamped in place in thin layers using a hammer and hardwood block. Holes passing entirely through walls shall be completely filled from the inside face by forcing mortar through to the outside face. All holes shall be packed full. Damp-pack repairs shall be moist cured for at least 48 hours.

#### 3.11.2 Repair of Major Defects

Major defects will be considered to be those more than 1/2 inch deep or, for Class B finishes, more than 1/2 inch in diameter and, for Class C finishes, more than 2 inches in diameter. Also included are any defects of any kind whose depth is over 4 inches or whose surface diameter is greater than their depth. Major defects shall be repaired as specified below.

##### 3.11.2.1 Surface Application of Mortar Repair

Defective concrete shall be removed, and removal shall extend into completely sound concrete. Approved equipment and procedures which will not cause cracking or microcracking of the sound concrete shall be used. If reinforcement is encountered, concrete shall be removed so as to expose the reinforcement for at least 2 inches on all sides. All such defective areas greater than 12 square inches shall be outlined by saw cuts at least 1 inch deep. Defective areas less than 12 square inches shall be outlined by a 1 inch deep cut with a core drill in lieu of sawing. All saw cuts shall be straight lines in a rectangular pattern in line with the formwork panels. After concrete removal, the surface shall be thoroughly cleaned by

high pressure washing to remove all loose material. Surfaces shall be kept continually saturated for the first 12 of the 24 hours immediately before placing mortar and shall be damp but not wet at the time of commencing mortar placement. The Contractor, at his option, may use either hand-placed mortar or mortar placed with a mortar gun. If hand-placed mortar is used, the edges of the cut shall be perpendicular to the surface of the concrete. The prepared area shall be brush-coated with a thin coat of neat cement grout. The repair shall then be made using a stiff mortar, preshrunk by allowing the mixed mortar to stand for 30 to 45 minutes and then remixed, thoroughly tamped into place in thin layers. If hand-placed mortar is used, the Contractor shall test each repair area for drumminess by firm tapping with a hammer and shall inspect for cracks, both in the presence of the Contracting Officer's representative, immediately before completion of the contract, and shall replace any showing drumminess or cracking. If mortar placed with a mortar gun is used, the gun shall be a small compressed air-operated gun to which the mortar is slowly hand fed and which applies the mortar to the surface as a high-pressure stream, as approved. Repairs made using shotcrete equipment will not be accepted. The mortar used shall be the same mortar as specified for damp-pack mortar repair. If gun-placed mortar is used, the edges of the cut shall be beveled toward the center at a slope of 1:1. All surface applied mortar repairs shall be continuously moist cured for at least 7 days. Moist curing shall consist of several layers of saturated burlap applied to the surface immediately after placement is complete and covered with polyethylene sheeting, all held closely in place by a sheet of plywood or similar material rigidly braced against it. Burlap shall be kept continually wet.

#### 3.11.2.2 Repair of Deep and Large Defects

Deep and large defects will be those that are more than 6 inches deep and also have an average diameter at the surface more than 18 inches or that are otherwise so identified by the Project Office. Such defects shall be repaired as specified herein or directed, except that defects which affect the strength of the structure shall not be repaired and that portion of the structure shall be completely removed and replaced. Deep and large defects shall be repaired by procedures approved in advance including forming and placing special concrete using applied pressure during hardening. Preparation of the repair area shall be as specified for surface application of mortar. In addition, the top edge (surface) of the repair area shall be sloped at approximately 20 degrees from the horizontal, upward toward the side from which concrete will be placed. The special concrete shall be a concrete mixture with low water content and low slump, and shall be allowed to age 30 to 60 minutes before use. Concrete containing a specified expanding admixture may be used in lieu of the above mixture; the paste portion of such concrete mixture shall be designed to have an expansion between 2.0 and 4.0 percent when tested in accordance with ASTM C 940. A full width "chimney" shall be provided at the top of the form on the placing side to ensure filling to the top of the opening. A pressure cap shall be used on the concrete in the chimney with simultaneous tightening and revibrating the form during hardening to ensure a tight fit for the repair. The form shall be removed after 24 hours and immediately the chimney shall be carefully chipped away to avoid breaking concrete out of the repair; the surface of the repair concrete shall be

dressed as required.

### 3.12 FINISHING UNFORMED SURFACES

The finish of all unformed surfaces shall meet the requirements of paragraph Tolerances in PART 1, when tested as specified herein.

#### 3.12.1 General

The ambient temperature of spaces adjacent to unformed surfaces being finished and of the base on which concrete will be placed shall be not less than 50 degrees F. In hot weather all requirements of paragraphs Hot Weather Requirements and Prevention of Plastic Shrinkage Cracking shall be met. Unformed surfaces that are not to be covered by additional concrete or backfill shall have a float finish, with additional finishing as specified below, and shall be true to the elevation shown on the drawings. Surfaces to receive additional concrete or backfill shall be brought to the elevation shown on the drawings, properly consolidated, and left true and regular. Unless otherwise shown on the drawings, exterior surfaces shall be sloped for drainage, as directed. Where drains are provided, interior floors shall be evenly sloped to the drains. Joints shall be carefully made with a jointing or edging tool. The finished surfaces shall be protected from stains or abrasions. Grate tampers or "jitterbugs" shall not be used for any surfaces. The dusting of surfaces with dry cement or other materials or the addition of any water during finishing shall not be permitted. If bleedwater is present prior to finishing, the excess water shall be carefully dragged off or removed by absorption with porous materials such as burlap. During finishing operations, extreme care shall be taken to prevent over finishing or working water into the surface; this can cause "crazing" (surface shrinkage cracks which appear after hardening) of the surface. Any slabs with surfaces which exhibit significant crazing shall be removed and replaced. During finishing operations, surfaces shall be checked with a 10 foot straightedge, applied in both directions at regular intervals while the concrete is still plastic, to detect high or low areas.

#### 3.12.2 Rough Slab Finish

As a first finishing operation for unformed surfaces and as final finish for slabs to receive mortar setting beds, the surface shall receive a rough slab finish prepared as follows. The concrete shall be uniformly placed across the slab area, consolidated as previously specified, and then screeded with straightedge strikeoffs immediately after consolidation to bring the surface to the required finish level with no coarse aggregate visible. Side forms and screed rails shall be provided, rigidly supported, and set to exact line and grade. Allowable tolerances for finished surfaces apply only to the hardened concrete, not to forms or screed rails.

Forms and screed rails shall be set true to line and grade. "Wet screeds" shall not be used.

#### 3.12.3 Floated Finish

Slabs to receive more than a rough slab finish shall next be given a wood float finish. All slabs on grade not recessed for setting 1300, and all

elevated floor slabs shall receive a floated finish. Floated finish shall be the final finish of all slabs not exposed to view in this final structure. The screeding shall be followed immediately by darbying or bull floating before bleeding water is present, to bring the surface to a true, even plane. Then, after the concrete has stiffened so that it will withstand a man's weight without imprint of more than 1/4 inch and the water sheen has disappeared, it shall be floated to a true and even plane free of ridges. Floating shall be performed by use of suitable hand floats or power driven equipment. Sufficient pressure shall be used on the floats to bring a film of moisture to the surface. Hand floats shall be made of wood, magnesium, or aluminum. Lightweight concrete or concrete that exhibits stickiness shall be floated with a magnesium float. Care shall be taken to prevent over-finishing or incorporating water into the surface.

#### 3.12.4 Troweled Finish

All slabs on grade and elevated slabs exposed to view in the final structure shall receive a troweled finish. After floating is complete and after the surface moisture has disappeared, unformed surfaces shall be steel-troweled to a smooth, even, dense finish, free from blemishes including trowel marks. In lieu of hand finishing, an approved power finishing machine may be used in accordance with the directions of the machine manufacturer. Additional trowelings shall be performed, either by hand or machine until the surface has been troweled 4 times, with waiting period between each. Care shall be taken to prevent blistering and if such occurs, troweling shall immediately be stopped and operations and surfaces corrected. A final hard steel troweling shall be done by hand, with the trowel tipped, and using hard pressure, when the surface is at a point that the trowel will produce a ringing sound. The finished surface shall be thoroughly consolidated and shall be essentially free of trowel marks and be uniform in texture and appearance. The concrete mixture used for troweled finished areas shall be adjusted, if necessary, in order to provide sufficient fines (cementitious material and fine sand) to finish properly.

#### 3.12.5 Omitted

#### 3.12.6 Non-Slip Finish

Non-slip floors shall be constructed in accordance with the following subparagraphs.

##### 3.12.6.1 Broomed

Areas as indicated on the drawings shall be given a broomed finish. After floating, the surface shall be lightly steel troweled, and then carefully scored by pulling a coarse fiber push-type broom across the surface. Brooming shall be transverse to traffic or at right angles to the slope of the slab. After the end of the curing period, the surface shall be vigorously broomed with a coarse fiber broom to remove all loose or semi-detached particles.

##### 3.12.6.2 Abrasive Aggregate

Areas as indicated on the drawings shall be given an abrasive aggregate finish. The concrete surface shall be given a float finish. Abrasive aggregate shall then immediately be uniformly sprinkled over the floated surface at a total rate of not less than 0.25 psf spread in two applications at right angles to each other. The surface shall then be troweled to a smooth, even finish that is uniform in texture and appearance and free from blemishes including trowels marks. Immediately after curing, cement paste and laitance covering the abrasive aggregate shall be removed by steel brushing, rubbing with abrasive stone, or sandblasting to expose the abrasive particles.

3.13 OMITTED

3.14 EXTERIOR SLAB AND RELATED ITEMS

3.14.1 Pavements

Pavements shall be constructed where shown on the drawings. After forms are set and underlying material prepared as specified, the concrete shall be placed uniformly throughout the area and thoroughly vibrated. As soon as placed and vibrated, the concrete shall be struck off and screeded to the crown and cross section and to such elevation above grade that when consolidated and finished, the surface of the pavement will be at the required elevation. The entire surface shall be tamped with the strike off, or consolidated with a vibrating screed, and this operation continued until the required compaction and reduction of internal and surface voids are accomplished. Care shall be taken to prevent bringing excess paste to the surface. Immediately following the final consolidation of the surface, the pavement shall be floated longitudinally from bridges resting on the side forms and spanning but not touching the concrete. If necessary, additional concrete shall be placed and screeded, and the float operated until a satisfactory surface has been produced. The floating operation shall be advanced not more than half the length of the float and then continued over the new and previously floated surfaces. After finishing is completed but while the concrete is still plastic, minor irregularities and score marks in the pavement surface shall be eliminated by means of long-handled cutting straightedges. Straightedges shall be 12 feet in length and shall be operated from the sides of the pavement and from bridges. A straightedge operated from the side of the pavement shall be equipped with a handle 3 feet longer than one-half the width of the pavement. The surface shall then be tested for trueness with a 12 foot straightedge held in successive positions parallel and at right angles to the center line of the pavement, and the whole area covered as necessary to detect variations. The straightedge shall be advanced along the pavement in successive stages of not more than one-half the length of the straightedge. Depressions shall be immediately filled with freshly mixed concrete, struck off, consolidated, and refinished. Projections above the required elevation shall also be struck off and refinished. The straightedge testing and finishing shall continue until the entire surface of the concrete is true. Before the surface sheen has disappeared and well before the concrete becomes nonplastic, the surface of the pavement shall be given a nonslip sandy surface texture by use of a burlap drag. A strip of clean, wet burlap from 3 to 5 feet wide and 2 feet longer than the pavement width shall be carefully pulled across the surface. Edges and

joints shall be rounded with an edger having a radius of 1/8 inch. Curing shall be as specified.

#### 3.14.2 Sidewalks

Concrete shall be 4 inches minimum thickness. Contraction joints shall be provided at 5 feet spaces unless otherwise indicated. Contraction joints shall be cut 1 inch deep with a jointing tool after the surface has been finished. Transverse expansion joints 1/2 inch thick shall be provided at changes in direction and where sidewalk abuts curbs, steps, rigid pavement, or other similar structures. Sidewalks shall be given a lightly broomed finish. A transverse slope of 1/4 inch per foot shall be provided, unless otherwise indicated. Variations in cross section shall be limited to 1/4 inch in 5 feet.

#### 3.14.3 Curbs and Gutters

Concrete shall be formed, placed, and finished by hand using a properly shaped "mule" or constructed using a slipform machine specially designed for this work. Contraction joints shall be cut 3 inches deep with a jointing tool after the surface has been finished. Expansion joints (1/2 inch wide) shall be provided at 100 feet maximum spacing unless otherwise indicated. Exposed surfaces shall be finished using a stiff bristled brush.

#### 3.14.4 Pits and Trenches

Pits and trenches shall be constructed as indicated on the drawings. Bottoms and walls shall be placed monolithically or waterstops and keys, shall be provided as approved.

### 3.15 CURING AND PROTECTION

#### 3.15.1 General

Concrete shall be cured by an approved method for the period of time given below:

|                               |        |
|-------------------------------|--------|
| Concrete with Type III cement | 3 days |
| All other concrete            | 7 days |

Immediately after placement, concrete shall be protected from premature drying, extremes in temperatures, rapid temperature change, mechanical injury and damage from rain and flowing water for the duration of the curing period. Air and forms in contact with concrete shall be maintained at a temperature above 50 degrees F for the first 3 days and at a temperature above 32 degrees F for the remainder of the specified curing period. Exhaust fumes from combustion heating units shall be vented to the outside of the enclosure, and heaters and ducts shall be placed and directed so as not to cause areas of overheating and drying of concrete surfaces or to create fire hazards. Materials and equipment needed for adequate curing and protection shall be available and at the site prior to placing concrete. No fire or excessive heat, including welding, shall be permitted near or in direct contact with the concrete at any time. Except as otherwise permitted by paragraph Membrane Forming Curing Compounds,

moist curing shall be provided for any areas to receive floor hardener, any paint or other applied coating, or to which other concrete is to be bonded.

Concrete containing silica fume shall be initially cured by fog misting during finishing, followed immediately by continuous moist curing. Except for plastic coated burlap, impervious sheeting alone shall not be used for curing.

#### 3.15.2 Moist Curing

Concrete to be moist-cured shall be maintained continuously wet for the entire curing period, commencing immediately after finishing. If water or curing materials used stain or discolor concrete surfaces which are to be permanently exposed, the concrete surfaces shall be cleaned as approved. When wooden forms are left in place during curing, they shall be kept wet at all times. If steel forms are used in hot weather, nonsupporting vertical forms shall be broken loose from the concrete soon after the concrete hardens and curing water continually applied in this void. If the forms are removed before the end of the curing period, curing shall be carried out as on unformed surfaces, using suitable materials. Surfaces shall be cured by ponding, by continuous sprinkling, by continuously saturated burlap or cotton mats, or by continuously saturated plastic coated burlap. Burlap and mats shall be clean and free from any contamination and shall be completely saturated before being placed on the concrete. The Contractor shall have an approved work system to ensure that moist curing is continuous 24 hours per day.

#### 3.15.3 Membrane Forming Curing Compounds

Concrete may be cured with a nonpigmented curing compound containing a fugitive dye in lieu of moist curing. Membrane curing shall not be used on surfaces that are to receive any subsequent treatment depending on adhesion or bonding to the concrete, including surfaces to which a smooth finish is to be applied or other concrete to be bonded. However, a styrene acrylate or chlorinated rubber compound meeting ASTM C 309, Class B requirements, may be used for floors that are to receive adhesive applications of resilient flooring. The curing compound selected shall be compatible with any subsequent paint, roofing, waterproofing or flooring specified. Membrane curing compound shall not be used on surfaces that are maintained at curing temperatures with free steam. Curing compound shall be applied to formed surfaces immediately after the forms are removed and prior to any patching or other surface treatment except the cleaning of loose sand, mortar, and debris from the surface. All surfaces shall be thoroughly moistened with water. Curing compound shall be applied to slab surfaces as soon as the bleeding water has disappeared, with the tops of joints being temporarily sealed to prevent entry of the compound and to prevent moisture loss during the curing period. The curing compound shall be applied in a two-coat continuous operation by approved motorized power-spraying equipment operating at a minimum pressure of 75 psi, at a uniform coverage of not more than 400 square feet per gallon for each coat, and the second coat shall be applied perpendicular to the first coat. Concrete surfaces which have been subjected to rainfall within 3 hours after curing compound has been applied shall be resprayed by the method and at the coverage specified. Surfaces on which clear compound is used shall be shaded from direct rays of the sun for the first 3 days. Surfaces coated with curing



compound shall be kept free of foot and vehicular traffic, and from other sources of abrasion and contamination during the curing period.

3.15.4 Omitted

3.15.5 Ponding or Immersion

Concrete shall be continually immersed throughout the curing period. Water shall not be more than 20 degrees F less than the temperature of the concrete.

3.15.6 Cold Weather Curing and Protection

When the daily ambient low temperature is less than 32 degrees F the temperature of the concrete shall be maintained above 40 degrees F for the first seven days after placing. During the period of protection removal, the air temperature adjacent to the concrete surfaces shall be controlled so that concrete near the surface will not be subjected to a temperature differential of more than 25 degrees F as determined by suitable temperature measuring devices furnished by the Contractor, as required, and installed adjacent to the concrete surface and 2 inches inside the surface of the concrete. The installation of the thermometers shall be made by the Contractor as directed.

3.16 SETTING BASE PLATES AND BEARING PLATES

After being properly positioned, column base plates, bearing plates for beams and similar structural members, and machinery and equipment base plates shall be set to the proper line and elevation nonshrink grout. The thickness of the mortar or grout shall be approximately 1/24 the width of the plate, but not less than 3/4 inch. Concrete and metal surfaces in contact with grout shall be clean and free of oil and grease, and concrete surfaces in contact with grout shall be damp and free of laitance when grout is placed.

3.16.1 Omitted

3.16.2 Nonshrink Grout

Nonshrink grout shall be a ready-mixed material requiring only the addition of water. Water content shall be the minimum that will provide a flowable mixture and completely fill the space to be grouted without segregation, bleeding, or reduction of strength.

3.16.2.1 Mixing and Placing of Nonshrink Grout

Mixing and placing shall be in conformance with the material manufacturer's instructions and as specified therein. Ingredients shall be thoroughly dry-mixed before adding water. After adding water, the batch shall be mixed for 3 minutes. Batches shall be of size to allow continuous placement of freshly mixed grout. Grout not used within 30 minutes after mixing shall be discarded. The space between the top of the concrete or machinery-bearing surface and the plate shall be filled solid with the grout. Forms shall be of wood or other equally suitable material for

completely retaining the grout on all sides and on top and shall be removed after the grout has set. The placed grout shall be carefully worked by rodding or other means to eliminate voids; however, overworking and breakdown of the initial set shall be avoided. Grout shall not be retempered or subjected to vibration from any source. Where clearances are unusually small, placement shall be under pressure with a grout pump. Temperature of the grout, and of surfaces receiving the grout, shall be maintained at 65 to 85 degrees F until after setting.

#### 3.16.2.2 Treatment of Exposed Surfaces

Exposed surfaces shall have a smooth-dense finish and be left untreated. Curing shall comply with paragraph CURING AND PROTECTION.

### 3.17 TESTING AND INSPECTION FOR CONTRACTOR QUALITY CONTROL

The Contractor shall perform the inspection and tests described below and, based upon the results of these inspections and tests, shall take the action required and shall submit specified reports. When, in the opinion of the Contracting Officer, the concreting operation is out of control, concrete placement shall cease and the operation shall be corrected. The laboratory performing the tests shall be onsite and shall conform with ASTM C 1077. Materials may be subjected to check testing by the Government from samples obtained at the manufacturer, at transfer points, or at the project site. The Government will inspect the laboratory, equipment, and test procedures prior to start of concreting operations and at least once per 7 days thereafter for conformance with ASTM C 1077.

#### 3.17.1 Grading and Corrective Action

##### 3.17.1.1 Fine Aggregate

At least once during each shift when the concrete plant is operating, there shall be one sieve analysis and fineness modulus determination in accordance with ASTM C 136 and COE CRD-C 104 for the fine aggregate or for each fine aggregate if it is batched in more than one size or classification. The location at which samples are taken may be selected by the Contractor as the most advantageous for control. However, the Contractor is responsible for delivering fine aggregate to the mixer within specification limits. When the amount passing on any sieve is outside the specification limits, the fine aggregate shall be immediately resampled and retested. If there is another failure on any sieve, the fact shall immediately reported to the Contracting Officer, concreting shall be stopped, and immediate steps taken to correct the grading.

##### 3.17.1.2 Coarse Aggregate

At least once during each shift in which the concrete plant is operating, there shall be a sieve analysis in accordance with ASTM C 136 for each size of coarse aggregate. The location at which samples are taken may be selected by the Contractor as the most advantageous for production control.

However, the Contractor shall be responsible for delivering the aggregate to the mixer within specification limits. A test record of samples of aggregate taken at the same locations shall show the results of the current

test as well as the average results of the five most recent tests including the current test. The Contractor may adopt limits for control coarser than the specification limits for samples taken other than as delivered to the mixer to allow for degradation during handling. When the amount passing any sieve is outside the specification limits, the coarse aggregate shall be immediately resampled and retested. If the second sample fails on any sieve, that fact shall be reported to the Contracting Officer. Where two consecutive averages of 5 tests are outside specification limits, the operation shall be considered out of control and shall be reported to the Contracting Officer. Concreting shall be stopped and immediate steps shall be taken to correct the grading.

#### 3.17.2 Quality of Aggregates

Thirty days prior to the start of concrete placement, the Contractor shall perform all tests for aggregate quality required by ASTM C 33. In addition, after the start of concrete placement, the Contractor shall perform tests for aggregate quality at least every three months, and when the source of aggregate or aggregate quality changes. Samples tested after the start of concrete placement shall be taken immediately prior to entering the concrete mixer.

#### 3.17.3 Scales, Batching and Recording

The accuracy of the scales shall be checked by test weights prior to start of concrete operations and at least once every three months. Such tests shall also be made as directed whenever there are variations in properties of the fresh concrete that could result from batching errors. Once a week the accuracy of each batching and recording device shall be checked during a weighing operation by noting and recording the required weight, recorded weight, and the actual weight batched. At the same time, the Contractor shall test and ensure that the devices for dispensing admixtures are operating properly and accurately. When either the weighing accuracy or batching accuracy does not comply with specification requirements, the plant shall not be operated until necessary adjustments or repairs have been made. Discrepancies in recording accuracies shall be corrected immediately.

#### 3.17.4 Batch-Plant Control

The measurement of concrete materials including cementitious materials, each size of aggregate, water, and admixtures shall be continuously controlled. The aggregate weights and amount of added water shall be adjusted as necessary to compensate for free moisture in the aggregates. The amount of air-entraining agent shall be adjusted to control air content within specified limits. A report shall be prepared indicating type and source of cement used, type and source of pozzolan or slag used, amount and source of admixtures used, aggregate source, the required aggregate and water weights per cubic yard, amount of water as free moisture in each size of aggregate, and the batch aggregate and water weights per cubic yard for each class of concrete batched during each day's plant operation.

#### 3.17.5 Concrete Mixture

- a. Air Content Testing. Air content tests shall be made when test specimens are fabricated. In addition, at least two tests for air content shall be made on randomly selected batches of each separate concrete mixture produced during each 8-hour period of concrete production. Additional tests shall be made when excessive variation in workability is reported by the placing foreman or Government inspector. Tests shall be made in accordance with ASTM C 231 for normal weight concrete and ASTM C 173 for lightweight concrete. Test results shall be plotted on control charts which shall at all times be readily available to the Government and shall be submitted weekly. Copies of the current control charts shall be kept in the field by testing crews and results plotted as tests are made. When a single test result reaches either the upper or lower action limit, a second test shall immediately be made. The results of the two tests shall be averaged and this average used as the air content of the batch to plot on both the air content and the control chart for range, and for determining need for any remedial action. The result of each test, or average as noted in the previous sentence, shall be plotted on a separate control chart for each mixture on which an "average line" is set at the midpoint of the specified air content range from paragraph Air Entrainment. An upper warning limit and a lower warning limit line shall be set 1.0 percentage point above and below the average line, respectively. An upper action limit and a lower action limit line shall be set 1.5 percentage points above and below the average line, respectively. The range between each two consecutive tests shall be plotted on a secondary control chart for range where an upper warning limit is set at 2.0 percentage points and an upper action limit is set at 3.0 percentage points. Samples for air content may be taken at the mixer, however, the Contractor is responsible for delivering the concrete to the placement site at the stipulated air content. If the Contractor's materials or transportation methods cause air content loss between the mixer and the placement, correlation samples shall be taken at the placement site as required by the Contracting Officer, and the air content at the mixer controlled as directed.
- b. Air Content Corrective Action. Whenever points on the control chart for percent air reach either warning limit, an adjustment shall immediately be made in the amount of air-entraining admixture batched. As soon as practical after each adjustment, another test shall be made to verify the result of the adjustment. Whenever a point on the secondary control chart for range reaches the warning limit, the admixture dispenser shall be recalibrated to ensure that it is operating accurately and with good reproducibility. Whenever a point on either control chart reaches an action limit line, the air content shall be considered out of control and the concreting operation shall immediately be halted until the air content is under control. Additional air content tests shall be made when concreting is restarted.
- c. Slump Testing. In addition to slump tests which shall be made when test specimens are fabricated, at least four slump tests

shall be made on randomly selected batches in accordance with ASTM C 143 for each separate concrete mixture produced during each 8-hour or less period of concrete production each day. Also, additional tests shall be made when excessive variation in workability is reported by the placing foreman or Government inspector. Test results shall be plotted on control charts which shall at all times be readily available to the Government and shall be submitted weekly. Copies of the current control charts shall be kept in the field by testing crews and results plotted as tests are made. When a single slump test reaches or goes beyond either the upper or lower action limit, a second test shall immediately be made. The results of the two tests shall be averaged and this average used as the slump of the batch to plot on both the control charts for slump and the chart for range, and for determining need for any remedial action. Limits shall be set on separate control charts for slump for each type of mixture. The upper warning limit shall be set at 1/2 inch below the maximum allowable slump specified in paragraph Slump in PART 1 for each type of concrete and an upper action limit line and lower action limit line shall be set at the maximum and minimum allowable slumps, respectively, as specified in the same paragraph. The range between each consecutive slump test for each type of mixture shall be plotted on a single control chart for range on which an upper action limit is set at 2 inches. Samples for slump shall be taken at the mixer. However, the Contractor is responsible for delivering the concrete to the placement site at the stipulated slump. If the Contractor's materials or transportation methods cause slump loss between the mixer and the placement, correlation samples shall be taken at the placement site as required by the Contracting Officer, and the slump at the mixer controlled as directed.

- d. Slump Corrective Action. Whenever points on the control charts for slump reach the upper warning limit, an adjustment shall immediately be made in the batch weights of water and fine aggregate. The adjustments are to be made so that the total water content does not exceed that amount allowed by the maximum w/c ratio specified, based on aggregates which are in a saturated surface dry condition. When a single slump reaches the upper or lower action limit, no further concrete shall be delivered to the placing site until proper adjustments have been made. Immediately after each adjustment, another test shall be made to verify the correctness of the adjustment. Whenever two consecutive individual slump tests, made during a period when there was no adjustment of batch weights, produce a point on the control chart for range at or above the upper action limit, the concreting operation shall immediately be halted, and the Contractor shall take appropriate steps to bring the slump under control. Additional slump tests shall be made as directed.
- e. Temperature. The temperature of the concrete shall be measured when compressive strength specimens are fabricated. Measurement shall be in accordance with ASTM C 1064/C 1064M. The temperature shall be reported along with the compressive strength data.

- f. Strength Specimens. At least one set of test specimens shall be made, for compressive or flexural strength as appropriate, on each different concrete mixture placed during the day for each 500 cubic yards or portion thereof of that concrete mixture placed each day. Additional sets of test specimens shall be made, as directed by the Contracting Officer, when the mixture proportions are changed or when low strengths have been detected. A truly random (not haphazard) sampling plan shall be developed by the Contractor and approved by the Contracting Officer prior to the start of construction. The plan shall assure that sampling is done in a completely random and unbiased manner. A set of test specimens for concrete with a 28-day specified strength per paragraph Strength Requirements in PART 1 shall consist of four specimens, two to be tested at 7 days and two at 28 days. A set of test specimens for concrete with a 90-day strength per the same paragraph shall consist of six specimens, two tested at 7 days, two at 28 days, and two at 90 days. Test specimens shall be molded and cured in accordance with ASTM C 31/C 31M and tested in accordance with ASTM C 39 for test cylinders and ASTM C 78 for test beams. Results of all strength tests shall be reported immediately to the Contracting Officer. Quality control charts shall be kept for individual strength "tests", ("test" as defined in paragraph Strength Requirements in PART 1) moving average of last 3 "tests" for strength, and moving average for range for the last 3 "tests" for each mixture. The charts shall be similar to those found in ACI 214.3R.

#### 3.17.6 Inspection Before Placing

Foundations, construction joints, forms, and embedded items shall be inspected by the Contractor in sufficient time prior to each concrete placement in order to certify to the Contracting Officer that they are ready to receive concrete. The results of each inspection shall be reported in writing.

#### 3.17.7 Placing

The placing foreman shall supervise placing operations, shall determine that the correct quality of concrete or grout is placed in each location as specified and as directed by the Contracting Officer, and shall be responsible for measuring and recording concrete temperatures and ambient temperature hourly during placing operations, weather conditions, time of placement, volume placed, and method of placement. The placing foreman shall not permit batching and placing to begin until it has been verified that an adequate number of vibrators in working order and with competent operators are available. Placing shall not be continued if any pile of concrete is inadequately consolidated. If any batch of concrete fails to meet the temperature requirements, immediate steps shall be taken to improve temperature controls.

#### 3.17.8 Vibrators

The frequency and amplitude of each vibrator shall be determined in

accordance with COE CRD-C 521 prior to initial use and at least once a month when concrete is being placed. Additional tests shall be made as directed when a vibrator does not appear to be adequately consolidating the concrete. The frequency shall be determined while the vibrator is operating in concrete with the tachometer being held against the upper end of the vibrator head while almost submerged and just before the vibrator is withdrawn from the concrete. The amplitude shall be determined with the head vibrating in air. Two measurements shall be taken, one near the tip and another near the upper end of the vibrator head, and these results averaged. The make, model, type, and size of the vibrator and frequency and amplitude results shall be reported in writing. Any vibrator not meeting the requirements of paragraph Consolidation, shall be immediately removed from service and repaired or replaced.

#### 3.17.9 Curing Inspection

- a. Moist Curing Inspections. At least once each shift, and not less than twice per day on both work and non-work days, an inspection shall be made of all areas subject to moist curing. The surface moisture condition shall be noted and recorded.
- b. Moist Curing Corrective Action. When a daily inspection report lists an area of inadequate curing, immediate corrective action shall be taken, and the required curing period for those areas shall be extended by 1 day.
- c. Membrane Curing Inspection. No curing compound shall be applied until the Contractor has verified that the compound is properly mixed and ready for spraying. At the end of each operation, the Contractor shall estimate the quantity of compound used by measurement of the container and the area of concrete surface covered, shall compute the rate of coverage in square feet per gallon, and shall note whether or not coverage is uniform.
- d. Membrane Curing Corrective Action. When the coverage rate of the curing compound is less than that specified or when the coverage is not uniform, the entire surface shall be sprayed again.
- e. Sheet Curing Inspection. At least once each shift and once per day on non-work days, an inspection shall be made of all areas being cured using impervious sheets. The condition of the covering and the tightness of the laps and tapes shall be noted and recorded.
- f. Sheet Curing Corrective Action. When a daily inspection report lists any tears, holes, or laps or joints that are not completely closed, the tears and holes shall promptly be repaired or the sheets replaced, the joints closed, and the required curing period for those areas shall be extended by 1 day.

#### 3.17.10 Cold-Weather Protection

At least once each shift and once per day on non-work days, an inspection shall be made of all areas subject to cold-weather protection. Any

deficiencies shall be noted, corrected, and reported.

#### 3.17.11 Mixer Uniformity

- a. Stationary Mixers. Prior to the start of concrete placing and once every 6 months when concrete is being placed, or once for every 75,000 cubic yards of concrete placed, whichever results in the shortest time interval, uniformity of concrete mixing shall be determined in accordance with ASTM C 94.
- b. Truck Mixers. Prior to the start of concrete placing and at least once every 6 months when concrete is being placed, uniformity of concrete mixing shall be determined in accordance with ASTM C 94. The truck mixers shall be selected randomly for testing. When satisfactory performance is found in one truck mixer, the performance of mixers of substantially the same design and condition of the blades may be regarded as satisfactory.
- c. Mixer Uniformity Corrective Action. When a mixer fails to meet mixer uniformity requirements, either the mixing time shall be increased, batching sequence changed, batch size reduced, or adjustments shall be made to the mixer until compliance is achieved.

#### 3.17.12 Reports

All results of tests or inspections conducted shall be reported informally as they are completed and in writing daily. A weekly report shall be prepared for the updating of control charts covering the entire period from the start of the construction season through the current week. During periods of cold-weather protection, reports of pertinent temperatures shall be made daily. These requirements do not relieve the Contractor of the obligation to report certain failures immediately as required in preceding paragraphs. Such reports of failures and the action taken shall be confirmed in writing in the routine reports. The Contracting Officer has the right to examine all contractor quality control records.

-- End of Section --



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SECTION 03410

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03/00

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SECTION 03410

PLANT-PRECAST STRUCTURAL CONCRETE  
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PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS  
(AASHTO)

AASHTO SSHB-I-14 Highway Bridges-Division I-Section 14:  
Bearings

ACI INTERNATIONAL (ACI)

ACI 304R (1989) Measuring, Mixing, Transporting,  
and Placing Concrete

ACI 305R (1991) Hot Weather Concreting

ACI 306.1 (1990) Cold Weather Concreting

ACI 309R (1996) Consolidation of Concrete

ACI 318/318M (1995) Building Code Requirements for  
Structural Concrete

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 27/A 27M (1995) Steel Castings, Carbon, for General  
Application

ASTM A 36/A 36M (1996) Carbon Structural Steel

ASTM A 47 (1990) Ferritic Malleable Iron Castings

ASTM A 123/A 123M (1997; Rev. A) Zinc (Hot-Dip Galvanized)  
Coatings on Iron and Steel Products

ASTM A 153/A 153M (1995) Zinc Coating (Hot-Dip) on Iron and  
Steel Hardware

ASTM A 185 (1997) Steel Welded Wire Fabric, Plain,  
for Concrete Reinforcement

|                   |   |
|-------------------|---|
| ASTM A 325        | (1997) Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength                  |
| ASTM A 497        | (1997) Steel Welded Wire Fabric, Deformed, for Concrete Reinforcement                               |
| ASTM A 563        | (1996) Carbon and Alloy Steel Nuts  |
| ASTM A 615/A 615M | (1996; Rev. A) Deformed and Plain Billet-Steel Bars for Concrete Reinforcement                      |
| ASTM A 616/A 616M | (1996; Rev. A) Rail-Steel Deformed and Plain Bars for Concrete Reinforcement                        |
| ASTM A 617/A 617M | (1996; Rev. A) Axle-Steel Deformed and Plain Bars for Concrete Reinforcement                        |
| ASTM A 780        | (1993; Rev. A) Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings                  |
| ASTM C 33         | (1997) Concrete Aggregates  |
| ASTM C 94         | (1997) Ready-Mixed Concrete   |
| ASTM C 150        | (1997) Portland Cement  |
| ASTM C 494        | (1992) Chemical Admixtures for Concrete   |
| ASTM C 618        | (1997) Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Concrete |
| ASTM C 989        | (1997) Ground Granulated Blast-Furnace Slag for Use in Concrete and Mortars                         |
| ASTM C 1107       | (1997) Packaged Dry, Hydraulic-Cement Grout (Nonshrink)   |
| ASTM F 436        | (1993) Hardened Steel Washers   |

AMERICAN WELDING SOCIETY (AWS)

|          |  |
|----------|--|
| AWS D1.4 | (1998) Structural Welding Code - Reinforcing Steel |
|----------|--|

PRECAST/PRESTRESSED CONCRETE INSTITUTE (PCI)

|             |   |
|-------------|---|
| PCI MNL-116 | (1985) Quality Control for Plants and Production of Precast Prestressed Concrete Products |
|-------------|---|

PCI MNL-120

(1992) Design Handbook - Precast and  
Prestressed Concrete

## 1.2 PRECAST MEMBERS

The work includes the provision of precast non-prestressed concrete herein referred to as precast members . Precast members shall be the product of a manufacturer specializing in the production of precast concrete members. In the ACI publications, the advisory provisions shall be considered to be mandatory, as though the word "shall" has been substituted for "should" wherever it appears; reference to the "Building Official," the "Structural Engineer" and the "Architect/Engineer" shall be interpreted to mean the Contracting Officer.

## 1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

### SD-02 Shop Drawings

Drawings of precast members; G,AE

### SD-03 Product Data

Anchorage and lifting inserts and devices

Bearing pads

### SD-05 Design Data

Precast concrete members design calculations; G,AE

Concrete mix design

### SD-06 Test Reports

Contractor-furnished mix design

Submit copies of test reports showing that the mix has been successfully tested to produce concrete with the properties specified and will be suitable for the job conditions. Obtain approval before concrete placement.

### SD-07 Certificates

Fabrication

Submit quality control procedures established in accordance with PCI MNL-116 by the precast manufacturer.

## SD-11 Closeout Submittals

### Concrete batch ticket information

#### 1.4 QUALITY CONTROL

##### 1.4.1 Precast Concrete Member Design

ACI 318/318M and the PCI MNL-120. Design precast members (including connections) for the design load conditions and spans indicated, and for additional loads imposed by openings and supports of the work of other trades. Design precast members for handling without cracking in accordance with the PCI MNL-120.

##### 1.4.2 PCI Quality Certifications

PCI MNL-116. At the precast manufacturer's option, in lieu of core samples, ACI 318/318M, full scale load tests may be performed. Perform on randomly selected members, as directed by the Contracting Officer.

###### 1.4.2.1 Product Quality Control

PCI MNL-116 for PCI enrolled plants. Where panels are manufactured by specialists in plants not currently enrolled in the PCI "Quality Control Program," provide a product quality control system in accordance with PCI MNL-116 and perform concrete and aggregate quality control testing using an approved, independent commercial testing laboratory. Submit test results to the Contracting Officer.

###### 1.4.2.2 Product Quality Control

Plants shall be certified by the PCI Plant Certification Program for Category C1 work.

#### 1.5 DELIVERY AND STORAGE

Lift and support precast members at the lifting and supporting points indicated on the shop drawings. Store precast members off the ground. Separate stacked precast members by battens across the full width of each bearing point. Protect from weather, marring, damage, and overload.

#### 1.6 FACTORY INSPECTION

At the option of the Contracting Officer, precast units may be inspected by the Contracting Officer prior to being transported to the job site. The Contractor shall give notice 14 days prior to the time the units will be available for plant inspection. Neither the exercise nor waiver of inspection at the plant will affect the Government's right to enforce contractual provisions after units are transported or erected.

#### 1.7 QUALITY ASSURANCE

##### 1.7.1 Drawing Information

Submit drawings indicating complete information for the fabrication, handling, and erection of the precast member. Drawings shall not be reproductions of contract drawings. Design calculations and drawings of precast members (including connections) shall be prepared and sealed by a registered professional engineer, and submitted for approval prior to fabrication. The drawings shall indicate, as a minimum, the following information:

- a. Marking of members for erection
- b. Connections for work of other trades
- c. Connections between members, and connections between members and other construction
- d. Location and size of openings
- e. Headers for openings
- f. Joints between members, and joints between members and other construction
- g. Reinforcing details
- h. Material properties of steel and concrete used
- i. Lifting and erection inserts
- j. Dimensions and surface finishes of each member
- k. Erection sequence and handling requirements
- l. All loads used in design (such as live, dead, handling, and erection)
- m. Bracing/shoring required

#### 1.7.2 Design Calculations

Submit calculations reflecting design conforming to requirements of paragraph entitled "Precast Concrete Member Design." Design calculations and drawings of precast members (including connections) shall be prepared and sealed by a registered professional engineer, and submitted for approval prior to fabrication.

#### 1.7.3 Concrete Mix Design

Thirty days minimum prior to concrete placement, submit a mix design for each strength and type of concrete. Include a complete list of materials including type; brand; source and amount of cement, pozzolan, and admixtures; and applicable reference specifications.

#### 1.7.4 Certificates: Record Requirement

ASTM C 94. Submit mandatory batch ticket information for each load of ready-mixed concrete.

## PART 2 PRODUCTS

### 2.1 CONTRACTOR-FURNISHED MIX DESIGN

ACI 318/318M. The minimum compressive strength of concrete at 28 days shall be 4000 psi, unless otherwise indicated. Add air-entraining admixtures at the mixer to produce between 4 and 6 percent air by volume.

### 2.2 MATERIALS

#### 2.2.1 Cement

ASTM C 150, Type II. The pozzolan/fly ash content shall not exceed 25 percent by weight of the total cementitious material. For exposed concrete, use one manufacturer for each type of cement, ground slag, fly ash, and pozzolan.

##### 2.2.1.1 Fly Ash and Pozzolan

ASTM C 618, Type F, except that the maximum allowable loss on ignition shall be 6 percent.

##### 2.2.1.2 Ground Iron Blast-Furnace Slag

ASTM C 989, Grade 100 or 120.

#### 2.2.2 Water

Water shall be fresh, clean, and potable.

#### 2.2.3 Aggregates

##### 2.2.3.1 Aggregates Selection

ASTM C 33, Size 57, except as modified herein. Obtain aggregates for exposed concrete surfaces from one source. Aggregates shall not contain any substance which may be deleteriously reactive with the alkalies in the cement.

#### 2.2.4 Grout

##### 2.2.4.1 Nonshrink Grout

ASTM C 1107.

##### 2.2.4.2 Cementitious Grout

Shall be a mixture of portland cement, sand, and water. Proportion one part cement to approximately 2.5 parts sand, with the amount of water based on placement method.



2.2.5    Admixtures

2.2.5.1    Omitted

2.2.5.2    Accelerating

ASTM C 494, Type C or E.

2.2.5.3    Water Reducing

ASTM C 494, Type A, E, or F.

2.2.6    Reinforcement

2.2.6.1    Reinforcing Bars

ASTM A 615/A 615M, Grade 60; ASTM A 617/A 617M, Grade 60; or ASTM A 616/A 616M, Grade 60.

2.2.6.2    Welded Wire Fabric

ASTM A 185 or ASTM A 497.

2.2.7    Metal Accessories

Provide ASTM A 123/A 123M or ASTM A 153/A 153M galvanized.

2.2.7.1    Inserts

ASTM A 47, Grade 32510 or 35018, or ASTM A 27/A 27M Grade U-60-30.

2.2.7.2    Structural Steel

ASTM A 36/A 36M.

2.2.7.3    Bolts

ASTM A 325.

2.2.7.4    Nuts

ASTM A 563.

2.2.7.5    Washers

ASTM F 436

2.2.8    Bearing Pads

2.2.8.1    Elastomeric

AASHTO SSHB-I-14, for plain neoprene bearings.

## 2.3 FABRICATION

PCI MNL-116 unless specified otherwise.

### 2.3.1 Forms

Brace forms to prevent deformation. Forms shall produce a smooth, dense surface. Chamfer exposed edges of columns and beams 3/4 inch, unless otherwise indicated. Provide threaded or snap-off type form ties.

### 2.3.2 Reinforcement Placement

ACI 318/318M for placement and splicing. Reinforcement may be preassembled before placement in forms. Provide exposed connecting bars, or other approved connection methods, between precast and cast-in-place construction. Remove any excess mortar that adheres to the exposed connections.

### 2.3.3 Concrete

#### 2.3.3.1 Concrete Mixing

ASTM C 94. Mixing operations shall produce batch-to-batch uniformity of strength, consistency, and appearance.

#### 2.3.3.2 Concrete Placing

ACI 304R, ACI 305R for hot weather concreting, ACI 306.1 for cold weather concreting, and ACI 309R, unless otherwise specified.

#### 2.3.3.3 Concrete Curing

Commence curing immediately following the initial set and completion of surface finishing. Provide curing procedures to keep the temperature of the concrete between 50 and 190 degrees F. When accelerated curing is used, apply heat at controlled rate and uniformly along the casting beds. Monitor temperatures at various points in a product line in different casts.

### 2.3.4 Surface Finish

Repairs located in a bearing area shall be approved by the Contracting Officer prior to repairs. Precast members containing hairline cracks which are visible and are less than 0.02 inches in width, may be accepted, except that cracks larger than 0.005 inches in width for surfaces exposed to the weather shall be repaired. Precast members which contain cracks greater than 0.02 inches in width shall be approved by the Contracting Officer, prior to being repaired. Any precast member that is structurally impaired or contains honeycombed section deep enough to expose reinforcing shall be rejected.

#### 2.3.4.1 Unformed Surfaces

Provide a floated finish.

#### 2.3.4.2 Formed Surfaces

PCI MNL-116 (Appendix A - Commentary), Chapter 3, for grades of surface finishes.

- a. Unexposed Surfaces: Provide a standard grade surface finish.
- b. Exposed Surfaces: Provide a standard grade surface finish. The combined area of acceptable defective areas shall not exceed 0.2 percent of the exposed to view surface area, and the patches shall be indistinguishable from the surrounding surfaces when dry.

### PART 3 EXECUTION

#### 3.1 SURFACE REPAIR

Prior to erection, and again after installation, precast members shall be checked for damage, such as cracking, spalling, and honeycombing. As directed by the Contracting Officer, precast members that do not meet the surface finish requirements specified in Part 2 in paragraph entitled "Surface Finish" shall be repaired, or removed and replaced with new precast members.

#### 3.2 ERECTION

Precast members shall be erected after the concrete has attained the specified compressive strength, unless otherwise approved by the precast manufacturer. Erect in accordance with the approved shop drawings. PCI MNL-116 and PCI MNL-120 (Chapter 8), for tolerances. Brace precast members, unless design calculations submitted with the shop drawings indicate bracing is not required. Follow the manufacturer's recommendations for maximum construction loads. Place precast members level, plumb, square, and true within tolerances. Align member ends.

#### 3.3 BEARING SURFACES

Shall be flat, free of irregularities, and properly sized. Size bearing surfaces to provide for the indicated clearances between the precast member and adjacent precast members or adjoining field placed surfaces. Correct bearing surface irregularities with nonshrink grout. Provide bearing pads where indicated or required. Do not use hardboard bearing pads in exterior locations. Place precast members at right angles to the bearing surface, unless indicated otherwise, and draw-up tight without forcing or distortion, with sides plumb.

#### 3.4 ANCHORAGE

Provide anchorage for fastening work in place. Conceal fasteners where practicable. Make threaded connections up tight and nick threads to prevent loosening.

#### 3.5 WELDING

AWS D1.4 for welding connections and reinforcing splices. Protect the

concrete and other reinforcing from heat during welding. Weld continuously along the entire area of contact. Grind smooth visible welds in the finished installation. Welding of epoxy-coated reinforcing is not allowed.

### 3.6 OPENINGS

Holes or cuts requiring reinforcing to be cut, which are not indicated on the approved shop drawing, shall only be made with the approval of the Contracting Officer and the precast manufacturer. Drill holes less than 12 inches in diameter with a diamond tipped core drill.

### 3.7 GALVANIZING REPAIR

Repair damage to galvanized coatings using ASTM A 780 zinc rich paint for galvanized surfaces damaged by handling, transporting, cutting, welding, bolting, or acid washing. Do not heat surfaces to which repair paint has been applied.

### 3.8 GROUTING

Clean and fill indicated keyways between precast members, and other indicated areas, solidly with nonshrink grout or cementitious grout. Provide reinforcing where indicated. Remove excess grout before hardening.

### 3.9 SEALANTS

Provide as indicated and as specified in Section 07900 JOINT SEALING.

-- End of Section --

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SECTION 04200

MASONRY

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SECTION 04200

MASONRY  
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PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

ACI INTERNATIONAL (ACI)

ACI SP-66 (1994) ACI Detailing Manual

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

|                   |   |
|-------------------|---|
| ASTM A 82         | (1997a) Steel Wire, Plain, for Concrete Reinforcement                       |
| ASTM A 153/A 153M | (2000) Zinc Coating (Hot-Dip) on Iron and Steel Hardware                    |
| ASTM A 615/A 615M | (2000) Deformed and Plain Billet-Steel Bars for Concrete Reinforcement      |
| ASTM C 90         | (2000) Loadbearing Concrete Masonry Units                                   |
| ASTM C 91         | (1999) Masonry Cement   |
| ASTM C 140        | (1999b) Sampling and Testing Concrete Masonry Units                         |
| ASTM C 270        | (2000) Mortar for Unit Masonry  |
| ASTM C 476        | (1999) Grout for Masonry  |
| ASTM C 494/C 494M | (1999a) Chemical Admixtures for Concrete                                    |
| ASTM C 578        | (1995) Rigid, Cellular Polystyrene Thermal Insulation                       |
| ASTM C 641        | (1982; R 1998e1) Staining Materials in Lightweight Concrete Aggregates      |
| ASTM C 780        | (2000) Preconstruction and Construction Evaluation of Mortars for Plain and |



Reinforced Unit Masonry

|             |   |
|-------------|---|
| ASTM C 1019 | (2000) Sampling and Testing Grout                                     |
| ASTM C 1072 | (2000) Measurement of Masonry Flexural Bond Strength                  |
| ASTM C 1289 | (1998) Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board |

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Masonry Work; G, RE

Drawings including plans, elevations, and details of wall reinforcement; details of reinforcing bars at corners and wall intersections; offsets; tops, bottoms, and ends of walls; control and expansion joints; and wall openings. Bar splice locations shall be shown. Bent bars shall be identified on a bending diagram and shall be referenced and located on the drawings. Wall dimensions, bar clearances, and wall openings greater than one masonry unit in area shall be shown. No approval will be given to the shop drawings until the Contractor certifies that all openings, including those for mechanical and electrical service, are shown. If, during construction, additional masonry openings are required, the approved shop drawings shall be resubmitted with the additional openings shown along with the proposed changes. Location of these additional openings shall be clearly highlighted. The minimum scale for wall elevations shall be 1/4 inch per foot. Reinforcement bending details shall conform to the requirements of ACI SP-66.

SD-03 Product Data

Cold Weather Installation

Cold weather construction procedures.

SD-04 Samples

Architectural Concrete Masonry Units (CMU)

Color samples of three stretcher units and one unit for each type of special shape. Units shall show the full range of color and texture. Samples shall be visually matched to existing before submittal.

#### SD-06 Test Reports

Field Testing of Mortar  
Field Testing of Grout  
Masonry Cement  
Fire-rated CMU

Test reports from an approved independent laboratory. Test reports on a previously tested material shall be certified as the same as that proposed for use in this project.

#### SD-07 Certificates

Concrete Masonry Units (CMU)  
Anchors, Ties, and Bar Positioners  
Expansion-Joint Materials  
Joint Reinforcement  
Reinforcing Steel Bars and Rods  
Masonry Cement  
Mortar Coloring  
Insulation  
Precast Concrete Items  
Mortar Admixtures  
Grout Admixtures

Certificates of compliance stating that the materials meet the specified requirements.

##### Insulation

Certificate attesting that the polyurethane or polyisocyanurate insulation furnished for the project contains recovered material, and showing an estimated percent of such recovered material.

#### 1.3 OMITTED

#### 1.4 DELIVERY, HANDLING, AND STORAGE

Materials shall be delivered, handled, stored, and protected to avoid chipping, breakage, and contact with soil or contaminating material.

##### 1.4.1 Masonry Units

Concrete masonry units shall be covered or protected from inclement weather. Prefabricated lintels shall be marked on top sides to show either the lintel schedule number or the number and size of top and bottom bars.

##### 1.4.2 Reinforcement, Anchors, and Ties

Steel reinforcing bars, coated anchors, ties, and joint reinforcement shall be stored above the ground. Steel reinforcing bars and uncoated ties shall be free of loose mill scale and rust.

#### 1.4.3 Cementitious Materials, Sand and Aggregates

Cementitious and other packaged materials shall be delivered in unopened containers, plainly marked and labeled with manufacturers' names and brands. Cementitious material shall be stored in dry, weathertight enclosures or be completely covered. Cement shall be handled in a manner that will prevent the inclusion of foreign materials and damage by water or dampness. Sand and aggregates shall be stored in a manner to prevent contamination or segregation.

### PART 2 PRODUCTS

#### 2.1 GENERAL REQUIREMENTS

The source of materials which will affect the appearance of the finished work shall not be changed after the work has started except with Contracting Officer's approval.

#### 2.2 OMITTED

#### 2.3 OMITTED

#### 2.4 CONCRETE MASONRY UNITS (CMU)

Hollow and solid concrete masonry units shall conform to ASTM C 90. Cement shall have a low alkali content and be of one brand.

##### 2.4.1 Aggregates

Lightweight aggregates and blends of lightweight and heavier aggregates in proportions used in producing the units, shall comply with the following requirements when tested for stain-producing iron compounds in accordance with ASTM C 641: by visual classification method, the iron stain deposited on the filter paper shall not exceed the "light stain" classification.

##### 2.4.2 Kinds and Shapes

Units shall be modular in size and shall include closer, jamb, header, lintel, and bond beam units and special shapes and sizes to complete the work as indicated. Units used in exposed masonry surfaces in any one building shall have a uniform fine to medium texture and a uniform color.

##### 2.4.2.1 Architectural Units

Units shall have patterned face shell. Face shell pattern shall be split ribbed and split face as indicated and shall visually match the existing units of the same type. Units shall be integrally colored during manufacture. Color shall be tan or buff, matching existing adjacent masonry units. Patterned face shell shall be properly aligned in the completed wall.

##### 2.4.2.2 Omitted

#### 2.4.3 Fire-Rated CMU

Concrete masonry units used in fire-rated construction shown on the drawings shall be of minimum equivalent thickness for the fire rating indicated and the corresponding type of aggregates indicated in TABLE I. Units containing more than one of the aggregates listed in TABLE I will be rated on the aggregate requiring the greater minimum equivalent thickness to produce the required fire rating.

TABLE I  
FIRE-RATED CONCRETE MASONRY UNITS

See note (a) below

| Aggregate Type                                   | Minimum equivalent thickness<br>inches for fire rating of: |         |         |
|--|--|---------|---------|
|  | 4 hours  | 3 hours | 2 hours |
| Pumice   | 4.7  | 4.0     | 3.0     |
| Expanded slag                                    | 5.0  | 4.2     | 3.3     |
| Expanded clay, shale,<br>or slate                | 5.7  | 4.8     | 3.7     |
| Limestone, scoria, cinders<br>or unexpanded slag | 5.9  | 5.0     | 4.0     |
| Calcareous gravel                                | 6.2  | 5.3     | 4.2     |
| Siliceous gravel                                 | 6.7  | 5.7     | 4.5     |

(a) Minimum equivalent thickness shall equal net volume as determined in conformance with ASTM C 140 divided by the product of the actual length and height of the face shell of the unit in inches. Where walls are to receive plaster or be faced with brick, or otherwise form an assembly; the thickness of plaster or brick or other material in the assembly will be included in determining the equivalent thickness.

2.5 OMITTED

2.6 OMITTED

2.7 OMITTED

#### 2.8 PRECAST CONCRETE ITEMS

Lintels, splashblocks and door sills shall be factory-made units from a plant regularly engaged in producing precast concrete units. Unless otherwise indicated, concrete shall be 4,000 psi minimum conforming to Section 03300 CAST-IN-PLACE STRUCTURAL CONCRETE using 1/2 inch to No. 4 nominal-size coarse aggregate, and minimum reinforcement shall be the

reinforcement required for handling of the units. Clearance of 3/4 inch shall be maintained between reinforcement and faces of units. Unless precast-concrete items have been subjected during manufacture to saturated-steam pressure of at least 120 psi for at least 5 hours, the items, after casting, shall be either damp-cured for 24 hours or steam-cured and shall then be aged under cover for 28 days or longer. Cast-concrete members weighing over 80 pounds shall have built-in loops of galvanized wire or other approved provisions for lifting and anchoring. Units shall have beds and joints at right angles to the face, with sharp true arises and shall be cast with drip grooves on the underside where units overhang walls. Exposed-to-view surfaces shall be free of surface voids, spalls, cracks, and chipped or broken edges. Precast units exposed-to-view shall be of uniform appearance and color. Unless otherwise specified, units shall have a smooth dense finish. Prior to use, each item shall be wetted and inspected for crazing. Items showing evidence of dusting, spalling, crazing, or having surfaces treated with a protective coating will be rejected.

#### 2.8.1 Lintels

Precast lintels, unless otherwise shown, shall be of a thickness equal to the wall and reinforced with two No. 4 bars for the full length. Top of lintels shall be labeled "TOP" or otherwise identified and each lintel shall be clearly marked to show location in the structure.

#### 2.8.2 Sills

Sills shall be cast with washes. Sills for windows having mullions shall be cast in sections with head joints at mullions and a 1/4 inch allowance for mortar joints. The ends of sills, except a 3/4 inch wide margin at exposed surfaces, shall be roughened for bond. Treads of door sills shall have rounded nosings.

#### 2.8.3 Splash Blocks

Splash blocks shall be as detailed. Reinforcement shall be the manufacturer's standard.

#### 2.9 OMITTED,

#### 2.10 MORTAR

Mortar shall be Type S in accordance with the proportion specification of ASTM C 270 except Type S cement-lime mortar proportions shall be 1 part cement, 1/2 part lime and 4-1/2 parts aggregate; when masonry cement ASTM C 91 is used the maximum air content shall be limited to 12 percent and performance equal to cement-lime mortar shall be verified. Verification of masonry cement performance shall be based on ASTM C 780 and ASTM C 1072. Mortar for prefaced concrete masonry unit wainscots shall contain aggregates with 100 percent passing the No. 8 sieve and 95 percent passing the No. 16 sieve. Cement shall have a low alkali content and be of one brand. Aggregates shall be from one source.

##### 2.10.1 Admixtures

In cold weather, a non-chloride based accelerating admixture may be used subject to approval. Accelerating admixture shall be non-corrosive, shall contain less than 0.2 percent chlorides, and shall conform to ASTM C 494/C 494M, Type C.

#### 2.10.2 Coloring

Mortar coloring shall be added to the mortar used for exposed masonry surfaces to produce a uniform color matching the adjacent masonry units. Mortar coloring shall not exceed 3 percent of the weight of cement for carbon black and ten percent of the weight of cement for all other pigments. Mortar coloring shall be chemically inert, of finely ground limeproof pigment, and furnished in accurately pre-measured and packaged units that can be added to a measured amount of cement.

#### 2.11 GROUT

Grout shall conform to ASTM C 476. Grout slump shall be between 8 and 10 inches. Grout shall be used subject to the limitations of Table III. Proportions shall not be changed and materials with different physical or chemical characteristics shall not be used in grout for the work unless additional evidence is furnished that the grout meets the specified requirements.

##### 2.11.1 Admixtures

In cold weather, a non-chloride based accelerating admixture may be used subject to approval. Accelerating admixture shall be non-corrosive, shall contain less than 0.2 percent chlorides, and shall conform to ASTM C 494/C 494M, Type C.

##### 2.11.2 Grout Barriers

Grout barriers for vertical cores shall consist of fine mesh wire, fiberglass, or expanded metal.

#### 2.12 ANCHORS, TIES, AND BAR POSITIONERS

Anchors and ties shall be fabricated without drips or crimps and shall be zinc-coated in accordance with ASTM A 153/A 153M, Class B-2. Steel wire used for anchors and ties shall be fabricated from steel wire conforming to ASTM A 82. Anchors and ties shall be sized to provide a minimum of 5/8 inch mortar cover from either face.

##### 2.12.1 Omitted

##### 2.12.2 Wall Ties

Wall ties shall be rectangular-shaped or Z-shaped fabricated of 3/16 inch diameter zinc-coated steel wire. Rectangular wall ties shall be no less than 4 inches wide. Wall ties may also be of a continuous type conforming to paragraph JOINT REINFORCEMENT. Adjustable type wall ties, if approved for use, shall consist of two essentially U-shaped elements fabricated of

3/16 inch diameter zinc-coated steel wire. Adjustable ties shall be of the double pintle to eye type and shall allow a maximum of 1/2 inch eccentricity between each element of the tie. Play between pintle and eye opening shall be not more than 1/16 inch. The pintle and eye elements shall be formed so that both can be in the same plane.

#### 2.12.3 Dovetail Anchors

Dovetail anchors shall be of the flexible wire type, 3/16 inch diameter zinc-coated steel wire, triangular shaped, and attached to a 12 gauge or heavier steel dovetail section. These anchors shall be used for anchorage of veneer wythes or composite-wall facings extending over the face of concrete columns, beams, or walls. Cells within vertical planes of these anchors shall be filled solid with grout for full height of walls or partitions, or solid units may be used. Dovetail slots are specified in Section 03300 CAST-IN-PLACE STRUCTURAL CONCRETE.

#### 2.12.4 Adjustable Anchors

Adjustable anchors shall be 3/16 inch diameter steel wire, triangular-shaped. Anchors attached to steel shall be 5/16 inch diameter steel bars placed to provide 1/16 inch play between flexible anchors and structural steel members. Spacers shall be welded to rods and columns. Equivalent welded-on steel anchor rods or shapes standard with the flexible-anchor manufacturer may be furnished when approved. Welds shall be cleaned and given one coat of zinc-rich touch up paint.

#### 2.12.5 Bar Positioners

Bar positioners, used to prevent displacement of reinforcing bars during the course of construction, shall be factory fabricated from 9 gauge steel wire or equivalent, and coated with a hot-dip galvanized finish. Not more than one wire shall cross the cell.

#### 2.13 JOINT REINFORCEMENT

Joint reinforcement shall be factory fabricated from steel wire conforming to ASTM A 82, welded construction. Tack welding will not be acceptable in reinforcement used for wall ties. Wire shall have zinc coating conforming to ASTM A 153/A 153M, Class B-2. All wires shall be a minimum of 9 gauge. Reinforcement shall be ladder type design, having one longitudinal wire in the mortar bed of each face shell for hollow units and one wire for solid units. Joint reinforcement shall be placed a minimum of 5/8 inch cover from either face. The distance between crosswires shall not exceed 16 inches. Joint reinforcement for straight runs shall be furnished in flat sections not less than 10 feet long. Joint reinforcement shall be provided with factory formed corners and intersections. If approved for use, joint reinforcement may be furnished with adjustable wall tie features.

#### 2.14 REINFORCING STEEL BARS AND RODS

Reinforcing steel bars and rods shall conform to ASTM A 615/A 615M, Grade 60.

2.15 OMITTED

2.16 EXPANSION-JOINT MATERIALS

Backer rod and sealant shall be adequate to accommodate joint compression equal to 50 percent of the width of the joint. The backer rod shall be compressible rod stock of polyethylene foam, polyurethane foam, butyl rubber foam, or other flexible, nonabsorptive material as recommended by the sealant manufacturer. Sealant shall conform to Section 07900JOINT SEALING.

2.17 INSULATION

2.17.1 Rigid Board-Type Insulation

Rigid board-type insulation shall be extruded polystyrene, polyurethane, or polyisocyanurate. Polystyrene shall conform to ASTM C 578. Polyisocyanurate shall conform to ASTM C 1289, Type I, Class 1 or 2, faced with aluminum foil on both sides of the foam. The insulation shall be a standard product and shall be marked with not less than the manufacturer's trademark or name, the specification number, the permeance and R-values.

2.17.1.1 Omitted

2.17.1.2 Omitted

2.17.1.3 Recovered Material

The polyurethane or polyisocyanurate foam shall have a minimum recovered material content of 9 percent by weight of the core material.

2.17.2 Insulation Adhesive

Insulation adhesive shall be specifically prepared to adhere the insulation to the masonry and, where applicable, to the thru-wall flashing. The adhesive shall not deleteriously affect the insulation, and shall have a record of satisfactory and proven performance for the conditions under which to be used.

2.18 FLASHING

Flashing shall be as specified in Section 07600 SHEET METALWORK, GENERAL.

2.19 WEEP HOLE VENTILATORS

Weephole ventilators shall be prefabricated aluminum grill type vents designed to prevent insect entry with maximum air entry. Ventilators shall be sized to match modular construction with a standard 3/8 inch mortar joint.

PART 3 EXECUTION

3.1 ENVIRONMENTAL REQUIREMENTS

3.1.1 Hot Weather Installation



The following precautions shall be taken if masonry is erected when the ambient air temperature is more than 99 degrees F in the shade and the relative humidity is less than 50 percent. All masonry materials shall be shaded from direct sunlight; mortar beds shall be spread no more than 4 feet ahead of masonry; masonry units shall be set within one minute of spreading mortar; and after erection, masonry shall be protected from direct exposure to wind and sun for 48 hours.

### 3.1.2 Cold Weather Installation

Before erecting masonry when ambient temperature or mean daily air temperature falls below 40 degrees F, a written statement of proposed cold weather construction procedures shall be submitted for approval. The following precautions shall be taken during all cold weather erection.

#### 3.1.2.1 Preparation

Ice or snow formed on the masonry bed shall be thawed by the application of heat. Heat shall be applied carefully until the top surface of the masonry is dry to the touch. Sections of masonry deemed frozen and damaged shall be removed before continuing construction of those sections.

- a. Air Temperature 40 to 32 Degrees F. Sand or mixing water shall be heated to produce mortar temperatures between 40 and 120 degrees F.
- b. Air Temperature 32 to 25 Degrees F. Sand and mixing water shall be heated to produce mortar temperatures between 40 and 120 degrees F. Temperature of mortar on boards shall be maintained above freezing.
- c. Air Temperature 25 to 20 Degrees F. Sand and mixing water shall be heated to provide mortar temperatures between 40 and 120 degrees F. Temperature of mortar on boards shall be maintained above freezing. Sources of heat shall be used on both sides of walls under construction. Windbreaks shall be employed when wind is in excess of 15 mph.
- d. Air Temperature 20 Degrees F and below. Sand and mixing water shall be heated to provide mortar temperatures between 40 and 120 degrees F. Enclosure and auxiliary heat shall be provided to maintain air temperature above 32 degrees F. Temperature of units when laid shall not be less than 20 degrees F.

#### 3.1.2.2 Completed Masonry and Masonry Not Being Worked On

- a. Mean daily air temperature 40 to 32 degrees F. Masonry shall be protected from rain or snow for 24 hours by covering with weather-resistive membrane.
- b. Mean daily air temperature 32 to 25 degrees F. Masonry shall be completely covered with weather-resistant membrane for 24 hours.
- c. Mean Daily Air Temperature 25 to 20 degrees F. Masonry shall be

completely covered with insulating blankets or equally protected for 24 hours.

- d. Mean Daily Temperature 20 degrees F and Below. Masonry temperature shall be maintained above 32 degrees F for 24 hours by enclosure and supplementary heat, by electric heating blankets, infrared heat lamps, or other approved methods.

### 3.2 LAYING MASONRY UNITS

Masonry units shall be laid in running bond, except that all exposed architectural masonry units shall be laid in stacked bond pattern. Facing courses shall be level with back-up courses, unless the use of adjustable ties has been approved in which case the tolerances shall be plus or minus 1/2 inch. Each unit shall be adjusted to its final position while mortar is still soft and plastic. Units that have been disturbed after the mortar has stiffened shall be removed, cleaned, and relaid with fresh mortar. Air spaces, cavities, chases, expansion joints, and spaces to be grouted shall be kept free from mortar and other debris. Units used in exposed masonry surfaces shall be selected from those having the least amount of chipped edges or other imperfections detracting from the appearance of the finished work. Vertical joints shall be kept plumb. Units being laid and surfaces to receive units shall be free of water film and frost. Solid units shall be laid in a nonfurrowed full bed of mortar. Mortar for veneer wythes shall be beveled and sloped toward the center of the wythe from the cavity side. Units shall be shoved into place so that the vertical joints are tight. Vertical joints of brick and the vertical face shells of concrete masonry units, except where indicated at control, expansion, and isolation joints, shall be completely filled with mortar. Mortar will be permitted to protrude up to 1/2 inch into the space or cells to be grouted. Means shall be provided to prevent mortar from dropping into the space below. In double wythe construction, the inner wythe may be brought up not more than 16 inches ahead of the outer wythe. Collar joints shall be filled with mortar or grout during the laying of the facing wythe, and filling shall not lag the laying of the facing wythe by more than 8 inches.

#### 3.2.1 Surface Preparation

Surfaces upon which masonry is placed shall be cleaned of laitance, dust, dirt, oil, organic matter, or other foreign materials and shall be slightly roughened to provide a surface texture with a depth of at least 1/8 inch. Sandblasting shall be used, if necessary, to remove laitance from pores and to expose the aggregate.

#### 3.2.2 Forms and Shores

Forms and shores shall be sufficiently rigid to prevent deflections which may result in cracking or other damage to supported masonry and sufficiently tight to prevent leakage of mortar and grout. Supporting forms and shores shall not be removed in less than 10 days.

#### 3.2.3 Concrete Masonry Units

Units in piers, pilasters, columns, starting courses on footings, solid

foundation walls, lintels, and beams, and where cells are to be filled with grout shall be full bedded in mortar under both face shells and webs. Other units shall be full bedded under both face shells. Head joints shall be filled solidly with mortar for a distance in from the face of the unit not less than the thickness of the face shell. Foundation walls below grade shall be grouted solid. Jamb units shall be of the shapes and sizes to conform with wall units. Solid units may be incorporated in the masonry work where necessary to fill out at corners, gable slopes, and elsewhere as approved. Double walls shall be stiffened at wall-mounted plumbing fixtures by use of strap anchors, two above each fixture and two below each fixture, located to avoid pipe runs, and extending from center to center of the double wall. Walls and partitions shall be adequately reinforced for support of wall-hung plumbing fixtures when chair carriers are not specified.

3.2.4 Omitted

3.2.5 Tolerances

Masonry shall be laid plumb, true to line, with courses level. Bond pattern shall be kept plumb throughout. Corners shall be square unless noted otherwise. Except for walls constructed of prefaced concrete masonry units, masonry shall be laid within the following tolerances (plus or minus unless otherwise noted):

TABLE II

TOLERANCES

Variation from the plumb in the lines  
and surfaces of columns, walls and arises

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|                           |          |
|---------------------------|----------|
| In adjacent masonry units | 1/8 inch |
| In 10 feet                | 1/4 inch |
| In 20 feet                | 3/8 inch |
| In 40 feet or more        | 1/2 inch |

Variations from the plumb for external corners,  
expansion joints, and other conspicuous lines

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|                    |          |
|--------------------|----------|
| In 20 feet         | 1/4 inch |
| In 40 feet or more | 1/2 inch |

Variations from the level for exposed lintels,  
sills, parapets, horizontal grooves, and other  
conspicuous lines

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|                    |          |
|--------------------|----------|
| In 20 feet         | 1/4 inch |
| In 40 feet or more | 1/2 inch |

Variation from level for bed joints and top

TOLERANCES

surfaces of bearing walls

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|                    |          |
|--------------------|----------|
| In 10 feet         | 1/4 inch |
| In 40 feet or more | 1/2 inch |

Variations from horizontal lines

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|                    |          |
|--------------------|----------|
| In 10 feet         | 1/4 inch |
| In 20 feet         | 3/8 inch |
| In 40 feet or more | 1/2 inch |

Variations in cross sectional dimensions of  
columns and in thickness of walls

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|       |          |
|-------|----------|
| Minus | 1/4 inch |
| Plus  | 1/2 inch |

3.2.6 Cutting and Fitting

Full units of the proper size shall be used wherever possible, in lieu of cut units. Cutting and fitting, including that required to accommodate the work of others, shall be done by masonry mechanics using power masonry saws. Concrete masonry units may be wet or dry cut. Wet cut units, before being placed in the work, shall be dried to the same surface-dry appearance as uncut units being laid in the wall. Cut edges shall be clean, true and sharp. Openings in the masonry shall be made carefully so that wall plates, cover plates or escutcheons required by the installation will completely conceal the openings and will have bottoms parallel with the masonry bed joints. Reinforced masonry lintels shall be provided above openings over 12 inches wide for pipes, ducts, cable trays, and other wall penetrations, unless steel sleeves are used.

3.2.7 Jointing

Joints shall be tooled when the mortar is thumbprint hard. Horizontal joints shall be tooled last. Joints shall be brushed to remove all loose and excess mortar. Mortar joints shall be finished as follows:

3.2.7.1 Flush Joints

Joints in concealed masonry surfaces and joints at electrical outlet boxes in wet areas shall be flush cut. Flush cut joints shall be made by cutting off the mortar flush with the face of the wall. Joints in unparged masonry walls below grade shall be pointed tight. Flush joints for architectural units, such as fluted units, shall completely fill both the head and bed joints.

3.2.7.2 Tooled Joints

Joints in exposed exterior and interior masonry surfaces shall be tooled slightly concave. Joints shall be tooled with a jointer slightly larger than the joint width so that complete contact is made along the edges of the unit. Tooling shall be performed so that the mortar is compressed and the joint surface is sealed. Jointer of sufficient length shall be used to obtain a straight and true mortar joint.

#### 3.2.7.3 Door and Window Frame Joints

On the exposed interior side of exterior frames, joints between frames and abutting masonry walls shall be raked to a depth of 3/8 inch. On the exterior side of exterior frames, joints between frames and abutting masonry walls shall be raked to a depth of 3/8 inch.

#### 3.2.8 Joint Widths

Joint widths shall be as follows:

##### 3.2.8.1 Concrete Masonry Units

Concrete masonry units shall have 3/8 inch joints, except for prefaced concrete masonry units.

#### 3.2.9 Embedded Items

Spaces around built-in items shall be filled with mortar. Openings around flush-mount electrical outlet boxes in wet locations shall be pointed with mortar. Anchors, ties, wall plugs, accessories, flashing, pipe sleeves and other items required to be built-in shall be embedded as the masonry work progresses. Anchors, ties and joint reinforcement shall be fully embedded in the mortar. Cells receiving anchor bolts and cells of the first course below bearing plates shall be filled with grout.

#### 3.2.10 Unfinished Work

Unfinished work shall be stepped back for joining with new work. Toothing may be resorted to only when specifically approved. Loose mortar shall be removed and the exposed joints shall be thoroughly cleaned before laying new work.

#### 3.2.11 Masonry Wall Intersections

Each course shall be masonry bonded at corners and elsewhere as shown. Masonry walls shall be anchored or tied together at corners and intersections with bond beam reinforcement and prefabricated corner or tee pieces of joint reinforcement as shown.

#### 3.2.12 Partitions

Partitions shall be continuous from floor to underside of floor or roof deck where shown. Openings in firewalls around joists or other structural members shall be filled as indicated or approved. Where suspended ceilings on both sides of partitions are indicated, the partitions other than those shown to be continuous may be stopped approximately 4 inches above the

ceiling level. An isolation joint shall be placed in the intersection between partitions and structural or exterior walls as shown. Interior partitions having 4 inch nominal thick units shall be tied to intersecting partitions of 4 inch units, 5 inches into partitions of 6 inch units, and 7 inches into partitions of 8 inch or thicker units. Cells within vertical plane of ties shall be filled solid with grout for full height of partition or solid masonry units may be used. Interior partitions having masonry walls over 4 inches thick shall be tied together with joint reinforcement. Partitions containing joint reinforcement shall be provided with prefabricated pieces at corners and intersections or partitions.

### 3.3 ANCHORED VENEER CONSTRUCTION

The inner and outer wythes shall be completely separated by a continuous airspace as shown on the drawings. Both the inner and the outer wythes shall be laid up together except when adjustable joint reinforcement assemblies are approved for use. When both wythes are not brought up together, through-wall flashings shall be protected from damage until they are fully enclosed in the wall. The airspace between the wythes shall be kept clear and free of mortar droppings by temporary wood strips laid on the wall ties and carefully lifted out before placing the next row of ties.

A coarse gravel or drainage material shall be placed behind the weep holes in the cavity to a minimum depth of 4 inches of coarse aggregate or 10 inches of drainage material to keep mortar droppings from plugging the weep holes.

### 3.4 WEEP HOLES

Weep holes shall be provided not more than 24 inches on centers in mortar joints of the exterior wythe above wall flashing, over foundations, bond beams, and any other horizontal interruptions of the cavity. Weep holes shall be constructed using weep hole ventilators. Other approved methods may be used for providing weep holes. Weep holes shall be kept free of mortar and other obstructions.

### 3.5 OMITTED

### 3.6 OMITTED

### 3.7 OMITTED

### 3.8 OMITTED

### 3.9 MORTAR

Mortar shall be mixed in a mechanically operated mortar mixer for at least 3 minutes, but not more than 5 minutes. Measurement of ingredients for mortar shall be by volume. Ingredients not in containers, such as sand, shall be accurately measured by the use of measuring boxes. Water shall be mixed with the dry ingredients in sufficient amount to provide a workable mixture which will adhere to the vertical surfaces of masonry units. Mortar that has stiffened because of loss of water through evaporation shall be retempered by adding water to restore the proper consistency and workability. Mortar that has reached its initial set or that has not been used within 2-1/2 hours after mixing shall be discarded.

### 3.10 REINFORCING STEEL

Reinforcement shall be cleaned of loose, flaky rust, scale, grease, mortar, grout, or other coating which might destroy or reduce its bond prior to placing grout. Bars with kinks or bends not shown on the drawings shall not be used. Reinforcement shall be placed prior to grouting. Unless otherwise indicated, vertical wall reinforcement shall extend to within 2 inches of tops of walls.

#### 3.10.1 Positioning Bars

Vertical bars shall be accurately placed within the cells at the positions indicated on the drawings. A minimum clearance of 1/2 inch shall be maintained between the bars and masonry units. Minimum clearance between parallel bars shall be one diameter of the reinforcement. Vertical reinforcing may be held in place using bar positioners located near the ends of each bar and at intermediate intervals of not more than 192 diameters of the reinforcement. Column and pilaster ties shall be wired in position around the vertical steel. Ties shall be in contact with the vertical reinforcement and shall not be placed in horizontal bed joints.

#### 3.10.2 Splices

Bars shall be lapped a minimum of 48 diameters of the reinforcement. Welded or mechanical connections shall develop at least 125 percent of the specified yield strength of the reinforcement.

#### 3.11 JOINT REINFORCEMENT

Joint reinforcement shall be installed at 16 inches on center or as indicated. Reinforcement shall be lapped not less than 6 inches. Prefabricated sections shall be installed at corners and wall intersections. The longitudinal wires of joint reinforcement shall be placed to provide not less than 5/8 inch cover to either face of the unit.

#### 3.12 PLACING GROUT

Cells containing reinforcing bars shall be filled with grout. Hollow masonry units in walls or partitions supporting plumbing, heating, or other mechanical fixtures, voids at door and window jambs, and other indicated spaces shall be filled solid with grout. Cells under lintel bearings on each side of openings shall be filled solid with grout for full height of openings. Walls below grade, lintels, and bond beams shall be filled solid with grout. Units other than open end units may require grouting each course to preclude voids in the units. Grout not in place within 1-1/2 hours after water is first added to the batch shall be discarded. Sufficient time shall be allowed between grout lifts to preclude displacement or cracking of face shells of masonry units. If blowouts, flowouts, misalignment, or cracking of face shells should occur during construction, the wall shall be torn down and rebuilt.

##### 3.12.1 Vertical Grout Barriers for Fully Grouted Walls

Grout barriers shall be provided not more than 30 feet apart, or as required, to limit the horizontal flow of grout for each pour.

### 3.12.2 Horizontal Grout Barriers

Grout barriers shall be embedded in mortar below cells of hollow units receiving grout.

### 3.12.3 Grout Holes and Cleanouts

#### 3.12.3.1 Grout Holes

Grouting holes shall be provided in slabs, spandrel beams, and other in-place overhead construction. Holes shall be located over vertical reinforcing bars or as required to facilitate grout fill in bond beams. Additional openings spaced not more than 16 inches on centers shall be provided where grouting of all hollow unit masonry is indicated. Openings shall not be less than 4 inches in diameter or 3 by 4 inches in horizontal dimensions. Upon completion of grouting operations, grouting holes shall be plugged and finished to match surrounding surfaces.

#### 3.12.3.2 Cleanouts for Hollow Unit Masonry Construction

Cleanout holes shall be provided at the bottom of every pour in cores containing vertical reinforcement when the height of the grout pour exceeds 5 feet. Where all cells are to be grouted, cleanout courses shall be constructed using bond beam units in an inverted position to permit cleaning of all cells. Cleanout holes shall be provided at a maximum spacing of 32 inches where all cells are to be filled with grout. A new series of cleanouts shall be established if grouting operations are stopped for more than 4 hours. Cleanouts shall not be less than 3 by 4 inch openings cut from one face shell. Manufacturer's standard cutout units may be used at the Contractor's option. Cleanout holes shall not be closed until masonry work, reinforcement, and final cleaning of the grout spaces have been completed and inspected. For walls which will be exposed to view, cleanout holes shall be closed in an approved manner to match surrounding masonry.

### 3.12.4 Grouting Equipment

#### 3.12.4.1 Grout Pumps

Pumping through aluminum tubes will not be permitted. Pumps shall be operated to produce a continuous stream of grout without air pockets, segregation, or contamination. Upon completion of each day's pumping, waste materials and debris shall be removed from the equipment, and disposed of outside the masonry.

#### 3.12.4.2 Vibrators

Internal vibrators shall maintain a speed of not less than 5,000 impulses per minute when submerged in the grout. At least one spare vibrator shall be maintained at the site at all times. Vibrators shall be applied at uniformly spaced points not further apart than the visible effectiveness of the machine. Duration of vibration shall be limited to time necessary to produce satisfactory consolidation without causing segregation.



### 3.12.5 Grout Placement

Masonry shall be laid to the top of a pour before placing grout. Grout shall not be placed in two-wythe solid unit masonry cavity until mortar joints have set for at least 3 days during hot weather and 5 days during cold damp weather. Grout shall not be placed in hollow unit masonry until mortar joints have set for at least 24 hours. Grout shall be placed using a hand bucket, concrete hopper, or grout pump to completely fill the grout spaces without segregation of the aggregates. Vibrators shall not be inserted into lower pours that are in a semi-solidified state. The height of grout pours and type of grout used shall be limited by the dimensions of grout spaces as indicated in Table III. Low-lift grout methods may be used on pours up to and including 5 feet in height. High-lift grout methods shall be used on pours exceeding 5 feet in height.

#### 3.12.5.1 Low-Lift Method

Grout shall be placed at a rate that will not cause displacement of the masonry due to hydrostatic pressure of the grout. Mortar protruding more than 1/2 inch into the grout space shall be removed before beginning the grouting operation. Grout pours 12 inches or less in height shall be consolidated by mechanical vibration or by puddling. Grout pours over 12 inches in height shall be consolidated by mechanical vibration and reconsolidated by mechanical vibration after initial water loss and settlement has occurred. Vibrators shall not be inserted into lower pours that are in a semi-solidified state. Low-lift grout shall be used subject to the limitations of Table III.

#### 3.12.5.2 High-Lift Method

Mortar droppings shall be cleaned from the bottom of the grout space and from reinforcing steel. Mortar protruding more than 1/4 inch into the grout space shall be removed by dislodging the projections with a rod or stick as the work progresses. Reinforcing, bolts, and embedded connections shall be rigidly held in position before grouting is started. CMU units shall not be pre-wetted. Grout, from the mixer to the point of deposit in the grout space shall be placed as rapidly as practical by pumping and placing methods which will prevent segregation of the mix and cause a minimum of grout splatter on reinforcing and masonry surfaces not being immediately encased in the grout lift. The individual lifts of grout shall be limited to 4 feet in height. The first lift of grout shall be placed to a uniform height within the pour section and vibrated thoroughly to fill all voids. This first vibration shall follow immediately behind the pouring of the grout using an approved mechanical vibrator. After a waiting period sufficient to permit the grout to become plastic, but before it has taken any set, the succeeding lift shall be poured and vibrated 12 to 18 inches into the preceding lift. If the placing of the succeeding lift is going to be delayed beyond the period of workability of the preceding, each lift shall be reconsolidated by reworking with a second vibrator as soon as the grout has taken its settlement shrinkage. The waiting, pouring, and reconsolidation steps shall be repeated until the top of the pour is reached. The top lift shall be reconsolidated after the required waiting period. The high-lift grouting of any section of wall

between vertical grout barriers shall be completed to the top of a pour in one working day unless a new series of cleanout holes is established and the resulting horizontal construction joint cleaned. High-lift grout shall be used subject to the limitations in Table III.

TABLE III

POUR HEIGHT AND TYPE OF GROUT FOR VARIOUS GROUT SPACE DIMENSIONS

| Maximum<br>Grout Pour<br>Height<br>(feet) (4) | Grout<br>Type | Grouting<br>Procedure | Minimum Dimensions of the<br>Total Clear Areas Within Grout<br>Spaces and Cells (in.) (1,2) |                        |
|---|---------------|-----------------------|---|------------------------|
|   |               |                       | Multiwythe<br>Masonry (3)   | Hollow-unit<br>Masonry |
| 1   | Fine          | Low Lift              | 3/4   | 1-1/2 x 2              |
| 5   | Fine          | Low Lift              | 2   | 2 x 3                  |
| 8   | Fine          | High Lift             | 2   | 2 x 3                  |
| 12  | Fine          | High Lift             | 2-1/2   | 2-1/2 x 3              |
| 24  | Fine          | High Lift             | 3   | 3 x 3                  |
| 1   | Coarse        | Low Lift              | 1-1/2   | 1-1/2 x 3              |
| 5   | Coarse        | Low Lift              | 2   | 2-1/2 x 3              |
| 8   | Coarse        | High Lift             | 2   | 3 x 3                  |
| 12  | Coarse        | High Lift             | 2-1/2   | 3 x 3                  |
| 24  | Coarse        | High Lift             | 3   | 3 x 4                  |

Notes:

- (1) The actual grout space or cell dimension must be larger than the sum of the following items:
  - a) The required minimum dimensions of total clear areas given in the table above;
  - b) The width of any mortar projections within the space;
  - c) The horizontal projections of the diameters of the horizontal reinforcing bars within a cross section of the grout space or cell.
- (2) The minimum dimensions of the total clear areas shall be made up of one or more open areas, with at least one area being 3/4 inch or greater in width.
- (3) For grouting spaces between masonry wythes.
- (4) Where only cells of hollow masonry units containing reinforcement are grouted, the maximum height of the pour shall not exceed the distance between horizontal bond beams.

### 3.13 BOND BEAMS

Bond beams shall be filled with grout and reinforced as indicated on the drawings. Grout barriers shall be installed under bond beam units to retain the grout as required. Reinforcement shall be continuous, including around corners, except through control joints or expansion joints, unless otherwise indicated on the drawings. Where splices are required for

continuity, reinforcement shall be lapped 48 bar diameters. A minimum clearance of 1/2 inch shall be maintained between reinforcement and interior faces of units.

### 3.14 CONTROL JOINTS

Control joints shall be provided as indicated and shall be constructed by using mortar to fill the head joint in accordance with the details shown on the drawings. The vertical mortar joint at control joint locations shall be continuous, including through all bond beams. This shall be accomplished by utilizing half blocks in alternating courses on each side of the joint. The control joint key shall be interrupted in courses containing continuous bond beam steel. In single wythe exterior masonry walls, the exterior control joints shall be raked to a depth of 3/4 inch; backer rod and sealant shall be installed in accordance with Section 07900 JOINT SEALING. Exposed interior control joints shall be raked to a depth of 1/4 inch. Concealed control joints shall be flush cut.

### 3.15 VENEER EXPANSION JOINTS AND CONCRETE MASONRY VENEER JOINTS

Concrete masonry veneer joints shall be provided and constructed as shown on the drawings. Joints shall be kept free of mortar and other debris.

### 3.16 OMITTED

### 3.17 LINTELS

#### 3.17.1 Masonry Lintels

Masonry lintels shall be constructed with lintel units filled solid with grout in all courses and reinforced with a minimum of two No. 4 bars in the bottom course unless otherwise indicated on the drawings. Lintel reinforcement shall extend beyond each side of masonry opening 40 bar diameters or 24 inches, whichever is greater. Reinforcing bars shall be supported in place prior to grouting and shall be located 1/2 inch above the bottom inside surface of the lintel unit.

#### 3.17.2 Precast Concrete and Steel Lintels

Precast concrete and steel lintels shall be as shown on the drawings. Lintels shall be set in a full bed of mortar with faces plumb and true. Steel and precast lintels shall have a minimum bearing length of 8 inches unless otherwise indicated on the drawings.

### 3.18 SILLS

Sills shall be set in a full bed of mortar with faces plumb and true.

### 3.19 OMITTED

### 3.20 OMITTED

### 3.21 PERIMETER AND UNDER SLAB INSULATION

Install perimeter thermal insulation where heated spaces are adjacent to

exterior walls or slab edges in slab-on-grade or floating-slab construction.

#### 3.21.1 Manufacturer's Instructions

Install, attach, tape edges, provide vapor retarder and other requirements such as protection against vermin, insects, damage during construction as recommended in manufacturer's instructions.

#### 3.21.2 Insulation on Vertical Surfaces

Install thermal insulation as indicated. Fasten insulation with adhesive.

#### 3.21.3 Protection of Insulation

Protect insulation on vertical surfaces from damage during construction and back filling by application of protection board or coating. Do not leave installed vertical insulation unprotected overnight.

#### 3.22 SPLASH BLOCKS

Splash blocks shall be located as shown.

#### 3.23 POINTING AND CLEANING

After mortar joints have attained their initial set, but prior to hardening, mortar and grout daubs or splashes shall be completely removed from masonry-unit surfaces that will be exposed or painted. Before completion of the work, defects in joints of masonry to be exposed or painted shall be raked out as necessary, filled with mortar, and tooled to match existing joints. Immediately after grout work is completed, scum and stains which have percolated through the masonry work shall be removed using a high pressure stream of water and a stiff bristled brush. Masonry surfaces shall not be cleaned, other than removing excess surface mortar, until mortar in joints has hardened. Masonry surfaces shall be left clean, free of mortar daubs, dirt, stain, and discoloration, including scum from cleaning operations, and with tight mortar joints throughout. Metal tools and metal brushes shall not be used for cleaning.

##### 3.23.1 Concrete Masonry Unit Surfaces

Exposed concrete masonry unit surfaces shall be dry-brushed at the end of each day's work and after any required pointing, using stiff-fiber bristled brushes.

#### 3.24 BEARING PLATES

Bearing plates for beams, joists, joist girders and similar structural members shall be set to the proper line and elevation with damp-pack bedding mortar, except where non-shrink grout is indicated. Bedding mortar and non-shrink grout shall be as specified in Section 03300 CAST-IN-PLACE STRUCTURAL CONCRETE.

#### 3.25 PROTECTION

Facing materials shall be protected against staining. Top of walls shall be covered with nonstaining waterproof covering or membrane when work is not in progress. Covering of the top of the unfinished walls shall continue until the wall is waterproofed with a complete roof or parapet system. Covering shall extend a minimum of 2 feet down on each side of the wall and shall be held securely in place. Before starting or resuming, top surface of masonry in place shall be cleaned of loose mortar and foreign material.

### 3.26 TEST REPORTS

#### 3.26.1 Field Testing of Mortar

At least three specimens of mortar shall be taken each day. A layer of mortar 1/2 to 5/8 inch thick shall be spread on the masonry units and allowed to stand for one minute. The specimens shall then be prepared and tested for compressive strength in accordance with ASTM C 780.

#### 3.26.2 Field Testing of Grout

Field sampling and testing of grout shall be in accordance with the applicable provisions of ASTM C 1019. A minimum of three specimens of grout per day shall be sampled and tested. Each specimen shall have a minimum ultimate compressive strength of 2000 psi at 28 days.

-- End of Section --

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DIVISION 04 - MASONRY

SECTION 04220

NONBEARING MASONRY VENEER/STEEL STUD WALLS

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DEPARTMENT OF THE ARMY  
U.S. ARMY CORPS OF ENGINEERS

CEGS-04220 (September 1998)

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Superseding  
CEGS-04255 (July 1992)

SECTION 04220

NONBEARING MASONRY VENEER/STEEL STUD WALLS  
**09/98**

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

AMERICAN INSTITUTE OF STEEL CONSTRUCTION (AISC)

AISC ASD Manual (1989) Manual of Steel Construction  
Allowable Stress Design

AMERICAN IRON AND STEEL INSTITUTE (AISI)

AISI Cold-Formed Mnl (1996) Cold-Formed Steel Design Manual

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

|                   |  |
|-------------------|--|
| ASTM A 36/A 36M   | (1997a) Carbon Structural Steel  |
| ASTM A 82         | (1997a) Steel Wire, Plain, for Concrete Reinforcement  |
| ASTM A 123/A 123M | (1997a) Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products  |
| ASTM A 153/A 153M | (1998) Zinc Coating (Hot-Dip) on Iron and Steel Hardware   |
| ASTM A 653/A 653M | (1998) Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process |
| ASTM C 79/C 79M   | (1997) Treated Core and Nontreated Core Gypsum Sheathing Board   |
| ASTM C 91         | (1998) Masonry Cement  |
| ASTM C 270        | (1997a) Mortar for Unit Masonry  |



|             |  |
|-------------|--|
| ASTM C 494  | (1998) Chemical Admixtures for Concrete  |
| ASTM C 665  | (1998) Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing  |
| ASTM C 780  | (1996) Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry  |
| ASTM C 955  | (1998) Load-Bearing (Transverse and Axial) Steel Studs, Runners (Tracks), and Bracing or Bridging for Screw Application of Gypsum Panel Products and Metal Plaster Bases |
| ASTM C 1002 | (1998) Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases  |
| ASTM C 1072 | (1998) Measurement of Masonry Flexural Bond Strength   |
| ASTM D 226  | (1997a) Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing   |
| ASTM D 1056 | (1998) Flexible Cellular Materials - Sponge or Expanded Rubber   |
| ASTM D 1330 | (1985; R 1995) Rubber Sheet Gaskets  |
| ASTM D 1667 | (1997) Flexible Cellular Materials - Vinyl Chlorine Polymers and Copolymers (Closed-Cell Foam)   |

AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING  
(ASHRAE)

|                |   |
|----------------|---|
| ASHRAE Hdbk-IP | (1997) Handbook, Fundamentals I-P Edition |
|----------------|---|

AMERICAN WELDING SOCIETY (AWS)

|          |  |
|----------|--|
| AWS D1.3 | (1998) Structural Welding Code - Sheet Steel |
|----------|--|

## 1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Detail Drawings

Details of cold-formed steel framing and support around openings, including framing connections, steel lintels, steel shelf angles, attachment to other building elements and bridging. Drawings shall indicate thickness, material, dimensions, protective coatings, and section properties of all steel lintels and shelf angles used in exterior wall framing. Drawings shall also indicate size and type of all fasteners including size and type of all welds.

SD-04 Samples

Expansion Joint Materials  
Concrete Masonry Unit

CMU samples shall visually match existing masonry.

Sample Panel

SD-06 Test Reports

Masonry Veneer/Steel Stud Wall System

Calculations demonstrating the structural adequacy of steel lintels and shelf angles for the calculated gravity loads being supported; this analysis shall be in accordance with AISC ASD Manual. Test results demonstrating that the veneer anchors are structurally adequate to resist the specified loadings shall be submitted for approval. Calculations demonstrating the insulation shown on the drawings provides the specified U-value for heat transmission of the completed exterior wall construction; this analysis shall be in accordance with ASHRAE Hdbk-IP. Manufacturer's descriptive data and installation instructions for the insulation, the vapor barrier and the moisture barrier.

SD-07 Certificates

Concrete Masonry Unit  
Joint Reinforcement  
Expansion Joint Materials  
Insulation  
Exterior Sheathing  
Moisture Barrier  
Vapor Retarder  
Veneer Anchors  
Welding

Certificates stating that the materials and welders meet the requirements specified. Each certificate shall be signed by an authorized certification official and shall include their organization and position and shall identify the products covered

under their certifying signature.

### 1.3 SAMPLE PANEL

After the material samples are approved and prior to starting masonry work, a sample masonry panel shall be built on the project site where directed. The sample panel shall be not less than 6 feet long by 4 feet high. The panel shall be of typical wall thickness for the construction represented. The panel shall show color range, texture, bond pattern, expansion joints, and cleaning of the masonry as required in the work. The panel shall also show cold-formed steel framing, insulation, gypsum wallboard, gypsum sheathing, moisture barrier, vapor barrier, veneer anchors, joint reinforcement, steel shelf angles, flashing and weep holes. The approved sample panel shall be used as a standard of workmanship required in the actual installation. The sample panel shall be protected from weather and construction operations and shall not be removed until the masonry veneer/steel stud wall work has been completed and accepted.

### 1.4 DELIVERY, HANDLING AND STORAGE

Materials shall be delivered and handled avoiding chipping, breakage, bending or other damage, and contact with soil or other contaminating materials. The masonry products shall be stored off the ground and protected from inclement weather. Cementitious materials shall be delivered in unopened containers plainly marked and labeled with manufacturer's names and brands. Cementitious materials shall be stored in dry, weather-tight enclosures or covers. Sand and other aggregates shall be stored preventing contamination or segregation and under a weather-tight covering permitting good air circulation. Finish of the framing members shall be maintained at all times, using an approved high zinc dust content galvanizing repair paint whenever necessary to prevent the formation of rust. Insulation, moisture barrier, and gypsum sheathing shall be stored in dry, well ventilated, weather-tight areas protected from sunlight and excessive heat. Air infiltration type vapor barrier shall be stored in accordance with the manufacturer's recommendations.

## PART 2 PRODUCTS

### 2.1 VENEER WYTHE

The source of masonry materials which will affect the appearance of the finished work shall not be changed after the work has started except with the Contracting Officer's approval.

#### 2.1.1 Concrete Masonry Units (CMU)

CMU shall be Architectural units as specified in Section 04200 MASONRY.

### 2.2 MORTAR

Mortar shall conform to ASTM C 270, Type S. Mortar mix shall be based on proportion specifications. Laboratory testing of mortar shall be in accordance with the preconstruction evaluation of mortar section of ASTM C 780. Cement shall have a low alkali content and be of one brand.

Aggregates shall be from one source.

#### 2.2.1 Masonry Cement

Masonry cement in conformance with ASTM C 91 may be used in the mortar. When using a masonry cement a comparative test shall be performed between a Portland cement-lime mortar and the masonry cement mortar proposed for the project to evaluate the ASTM C 1072 bond and the ASTM C 780 compressive strength of the two mixes. The test shall be conducted with the proposed masonry units for the project. The masonry cement mortar will be acceptable if the bond and compressive strength values are equal to or higher than the portland cement-lime mix. The air-content of the masonry cement shall be limited to 12 percent maximum.

#### 2.2.2 Admixtures

In cold weather, a non-chloride based accelerating admixture may be used subject to approval. Accelerating admixtures shall be non-corrosive, contain less than 0.2 percent chlorides, and conform to ASTM C 494, Type C.

#### 2.2.3 Coloring

Mortar coloring shall be added to the mortar used for exposed masonry surfaces to produce a uniform color visually matching the color indicated on the drawings by reference to a manufacturer's standard color. Mortar coloring shall not exceed 3 percent of the weight of cement for carbon black and ten percent of the weight of cement for all other pigments. Mortar coloring shall be chemically inert, of finely ground limeproof pigment, and furnished in accurately pre-measured and packaged units that can be added.

### 2.3 JOINT REINFORCEMENT

Joint reinforcement shall be of steel wire conforming to ASTM A 82. Fabrication shall be by welding. Tack welding will not be permitted. Reinforcement shall be zinc-coated after fabrication in accordance with ASTM A 153/A 153M, Class B-2. Joint reinforcement shall consist of at least 1 continuous longitudinal wire in the veneer wythe. Minimum wire cross section shall be 0.017 square inches.

### 2.4 COLD-FORMED STEEL FRAMING

Cold-formed framing shall consist of steel studs, top and bottom tracks, runners, horizontal bridging, and other cold-formed members and other accessories. All members and components made of sheet steel shall be hot-dip galvanized in accordance with ASTM A 653/A 653M with a minimum coating thickness of G 60. Framing covered herein shall be used only in framing the exterior masonry veneer steel stud wall system as indicated on the detail drawings. Metal framing for interior partitions are specified in Section 09250 GYPSUM WALLBOARD. Metal framing for miscellaneous roof members is specified in Section 05400, "Cold-Formed Steel Framing."

#### 2.4.1 Steel Studs

Studs shall be furnished as shown in the contract drawings.

#### 2.4.2 Runners, Tracks, Bridging and Accessories

Cold-formed steel sheet framing members, components, and accessories, other than the steel studs, shall conform to ASTM C 955 and be of steel conforming to ASTM A 653/A 653M, Grade 33, having a minimum yield strength of 33,000 psi.

#### 2.5 INSULATION

##### 2.5.1 Blanket Insulation

Insulation placed between the steel studs shall be batt or blanket type mineral wool conforming to ASTM C 665, Type II.

#### 2.6 GYPSUM WALLBOARD

Gypsum wallboard that is installed on the interior side of the cold-formed steel framing system shall be as specified in Section 09250 GYPSUM WALLBOARD.

#### 2.7 EXTERIOR SHEATHING

Gypsum sheathing that is installed on the exterior side of the cold-formed steel framing system shall have a minimum thickness of 1/2 inch and shall be 4 feet wide. Gypsum sheathing shall conform to ASTM C 79/C 79M. Gypsum sheathing shall have a water-resistant gypsum core with a water-repellent paper firmly bonded to the core.

#### 2.8 MOISTURE PROTECTION

##### 2.8.1 Moisture Barrier

The moisture barrier shall be 15-lb asphalt-saturated felt conforming to ASTM D 226 Type I (No. 15).

##### 2.8.2 Omitted

##### 2.8.3 Staples

Staples for attaching the moisture barrier to the exterior sheathing shall be the type and size best suited to provide a secure connection. Staples shall be made from either galvanized steel or stainless steel wire.

#### 2.9 VENEER ANCHORS

Anchor assemblies for the attachment of the masonry veneer to the cold-formed steel framing, structural steel and/or concrete beam and column members, and concrete floor slabs shall be designed for the design loadings shown. Anchors shall transfer the design loadings from the masonry veneer to the cold-formed steel framing system or other support without exceeding the allowable stresses and deflections in the anchors. Length of anchor wires shall be such that the outermost wires lie between 1-1/4 inch from

each face of the masonry veneer. Anchors wires shall not have drips. Wires for veneer anchors shall be rectangular or triangular hoops formed from 3/16 inch diameter steel wire conforming to ASTM A 82. Anchor assemblies including wires and anchor plates shall be hot-dip galvanized conforming to ASTM A 153/A 153M, Class B-2. The veneer anchor shall have a minimum capacity of 200 pounds. The load-displacement capacity of each veneer anchor, both in direct pull-out for tension and compression, shall be not less than 2000 pounds per inch (or a deflection of 0.05 inches per 100 pounds of load in tension or compression). In the direction perpendicular to the masonry veneer, the anchor assembly shall have a maximum play of 1/16 inch.

#### 2.9.1 Adjustable Pintle-Eye Type Wire Anchors

Adjustable pintle-eye type wall anchors shall be two pieces rectangular type double pintle anchors.

#### 2.9.2 Dovetail Anchors

Dovetail slots are specified in Section 03300 CAST-IN-PLACE STRUCTURAL CONCRETE.

### 2.10 CONNECTIONS

Screws, bolts and anchors shall be hot-dip galvanized in accordance with ASTM A 123/A 123M or ASTM A 153/A 153M as appropriate.

#### 2.10.1 Framing Screws, Bolts and Anchors

Screws, bolts and anchors used in the assembly of the cold-formed steel framing system shall be as required by design of the framing system for the specified loading. Screw, bolt and anchor sizes shall be shown on the detail drawings.

#### 2.10.2 Welding

Welded connections shall be designed and all welding shall be performed in accordance with AWS D1.3, as modified by AISI Cold-Formed Mnl. Welders shall be qualified in accordance with AWS D1.3. All welds shall be cleaned and touched-up with zinc-rich paint.

#### 2.10.3 Veneer Anchor Screws

Screws for attachment of the veneer anchors to the cold-formed steel framing members shall be as required by design to provide the needed pullout load capacity but not less than No. 12. Screws shall be shown on the detail drawings. The length of screws shall be such that the screws penetrate the holding member by not less than 5/8 inch.

#### 2.10.4 Gypsum Sheathing Screws

Screws for attachment of gypsum sheathing to cold-formed steel framing shall conform to ASTM C 1002, Type S.

#### 2.11 SYNTHETIC RUBBER WASHERS

Synthetic rubber washers for placement between veneer anchors and the moisture barrier on the outside face of the exterior sheathing shall conform to ASTM D 1330, Grade I.

#### 2.12 EXPANSION JOINT MATERIALS

Expansion joint materials shall be bellows or U-shaped type conforming to Section 07600 SHEET METALWORK, GENERAL. Premolded type shall be closed-cell cellular rubber conforming to ASTM D 1056 or closed-cell vinyl or polyvinyl chloride conforming to ASTM D 1667.

#### 2.13 FLASHING

Copper flashing shall conform to the requirements in Section 07600 SHEET METALWORK, GENERAL. Flashing shall be supplied in a continuous sheet extending from the exterior sheathing across the cavity and through the masonry veneer as shown.

#### 2.14 STEEL LINTELS AND SHELF ANGLES

Steel shapes used for lintels and shelf angles shall conform to ASTM A 36/A 36M. Lintels and shelf angles shall be provided as shown. These steel members shall be hot-dip galvanized in accordance with ASTM A 123/A 123M.

#### 2.15 CAULKING AND SEALANTS

Caulking and sealants shall be as specified in Section 07900 JOINT SEALING.

### PART 3 EXECUTION

#### 3.1 GENERAL INSTALLATION REQUIREMENTS

Wall sections, types of construction and dimensions shall be as shown. Metal door and window frames and other special framing shall be built and anchored into the wall system as indicated.

#### 3.2 STEEL STUD WALL FRAMING

The top track of the stud wall system shall be slip jointed to accommodate vertical deflections of the supporting members as shown on the drawings. Top and bottom tracks shall be securely anchored to resist track rotation by alternating fastener locations to provide two rows, one row near each track flange as shown on the drawings. Both flanges of all steel studs shall be securely fastened with screws to the flanges of the top and bottom tracks as shown on the drawings. All details for affixing steel studs to runners and all other sheet steel framing members along with all details necessary for anchorage of the steel stud wall system to the building structural systems shall be as shown on the drawings. Horizontal bridging shall be provided as necessary. Studs shall be spaced as indicated on the drawings. Coordinate stud spacing with sheathing and anchor requirements. At wall openings for doors, windows and other similar features, the framing system shall provide for the installation and anchorage of the required

subframes or finish frames. Steel frames shall be securely attached through built-in anchors to the nearest stud on each side of the opening with self-drilling screws. Double studs shall be provided at both jambs of all door openings. Door frames and other built-in items shall be grouted solid.

### 3.3 STEEL SHELF ANGLES

Unless otherwise shown, steel shelf angles shall be provided in segments that do not exceed 10 feet in length. At building corners, shelf angle segments shall be mitered and securely attached together by welding with legs no less than 4 feet where possible. Shelf angle segments shall not be connected together but instead shall be installed with 1/4 inch wide gaps between the segments. Fabrication and erection tolerances shall be in accordance with the AISC Code of Standard Practice, as indicated in AISC ASD Manual.

### 3.4 INSULATION

The actual installed thickness of insulation shall provide a maximum thermal R of 22 for the completed exterior wall construction as determined in accordance with ASHRAE Hdbk-IP. Insulation thickness shall be as shown on the approved drawings. Installation, except as otherwise specified or shown, shall be in accordance with the manufacturer's instructions which shall be approved by the Contracting Officer. Insulation shall be installed between wall framing members. Rigid insulation shall be installed in accordance with the manufacturer's instructions with proper connections through the insulation to prevent the insulation from carrying loads directly. Insulation with facings shall be secured to the sides of the framing members to provide a continuous seal so that the entire weight of the insulation is carried by the framing members. Where electrical outlets, ducts, pipes, vents or other utility items occur, insulation shall be placed on the dry side of the item away from excessive humidity.

### 3.5 GYPSUM WALLBOARD

Gypsum wallboard shall be installed on the interior face of the cold-formed steel framing system. Installation shall be as specified in Section 09250 GYPSUM WALLBOARD except at vertical slip joints, the gypsum wallboard shall be connected to the vertical studs to prevent movement at the slip joint.

### 3.6 EXTERIOR SHEATHING

Sheathing shall be installed on the exterior face of the cold-formed steel framing system with self-drilling screws. Screws shall be located a minimum of 3/8 inch from the ends and edges of sheathing panels and shall be spaced not more than 8 inches on each supporting member except at vertical slip joints, the sheathing shall be connected to the vertical studs to prevent movement of the slip joint. Edges and ends of gypsum sheathing panels shall be butted snugly with vertical joints staggered to provide full and even support for the moisture barrier. Holes and gaps resulting from abandoned screw installations, from damage to panels, and from cutting and fitting of panels at junctures with doors, windows, foundation walls, floor slabs and other similar locations shall be filled



with exterior rubber-base caulk.

### 3.7 MOISTURE PROTECTION

#### 3.7.1 Moisture Barrier

The asphalt-saturated felt or other approved moisture barrier shall be installed on the outer face of the exterior sheathing. The moisture barrier shall be installed horizontally and shingled with each sheet lapped not less than 6 inches over the sheet below. Vertical end joints shall be lapped not less than 6 inches and shall be staggered. Attachment of the moisture barrier shall be with staples spaced not greater than 16 inches on center or as required by the manufacturer.

#### 3.7.2 Vapor Retarder

A vapor retarder shall be installed between the steel studs and the gypsum wall board. The vapor retarder shall be installed in accordance with the manufacturer's recommendations to form a complete retarder to vapor infiltration. The joints shall be lapped and sealed with tape.

### 3.8 VENEER ANCHORS

anchor assemblies for the attachment of the masonry veneer to the cold-formed steel framing, structural steel and/or concrete beam and column members, and concrete floor slabs shall be designed for the design loadings shown. Anchors shall transfer the design loadings from the masonry veneer to the cold-formed steel framing system or other support without exceeding the allowable stresses and deflections in the anchors. Length of anchor wires shall be such that the outermost wires lie between 32 mm from each face of the masonry veneer. Anchor wires shall not have drips. Wires for 9 gage veneer anchors shall be rectangular or triangular hoops formed from 3/16 inch diameter steel wire conforming to ASTM A 82. Anchor assemblies including wires and anchor plates shall be hot-dip galvanized conforming to ASTM A 153, Class B-2. The veneer anchor shall have a minimum capacity of 900 newtons. The load-

### 3.9 FLASHING

Continuous flashing shall be provided at the bottom of the wall cavity just above grade. Flashing shall also be provided above and below openings at lintels and sills, at shelf angles, and as indicated on the drawings. Flashing shall be as detailed and as specified in Section 07600 SHEET METALWORK, GENERAL. Flashing shall be lapped a minimum of 6 inches at joints and shall be sealed with a mastic as recommended by the flashing manufacturer. Ends over doors, windows and openings shall be turned up and secured. Flashing shall be lapped under the moisture barrier a minimum of 6 inches and securely attached to the gypsum sheathing. Flashing shall extend through the exterior face of the masonry veneer and shall be turned down to form a drip.

### 3.10 MASONRY VENEER

Exterior masonry wythes shall be constructed to the thickness indicated on

the drawings. A cavity consisting of a 2 inch minimum width air space will be provided between the moisture barrier and the masonry veneer. Masonry veneer shall not be installed until the exterior sheathing, moisture barrier, veneer anchors and flashing have been installed on the cold-formed steel framing system. Extreme care shall be taken to avoid damage to the moisture barrier and flashing during construction of the masonry veneer. Any portion of the moisture barrier and flashing that is damaged shall be repaired or replaced prior to completion of the veneer. Masonry shall be placed in running bond pattern. Vertical joints on alternating courses shall be aligned and kept vertically plumb. Solid masonry units shall be laid in a non-furrowed full bed of mortar, beveled and sloped toward the center of the wythe on which the mortar is placed. Units shall be shoved into place so that the vertical mortar joints are completely full and tight. Units that have been disturbed after the mortar has stiffened shall be removed, cleaned and relaid. Mortar which protrudes more than 1/2 inch into the cavity space shall be removed. Means shall be provided to ensure that the cavity space is kept clean of mortar droppings and other loose debris. Chases and raked-out joints shall be kept free from mortar and debris. Faces of units used in finished exposed areas shall be free from chipped edges, material texture or color defects or other imperfections distracting from the appearance of the finished work.

#### 3.10.1 Surface Preparation

Surfaces on which masonry is to be laid shall be cleaned of laitance or other foreign material. No units having a film of water shall be laid.

#### 3.10.2 Hot Weather Construction

Temperatures of masonry units and mortar shall not be greater than 120 degrees F when laid. Masonry erected when the ambient air temperature is more than 99 degrees F in the shade and when the relative humidity is less than 50 percent shall be given protection from the direct exposure to wind and sun for 48 hours after the installation.

#### 3.10.3 Cold Weather Construction

Temperatures of masonry units and mortar shall not be less than 40 degrees F when laid. When the ambient air temperature is 32 degrees F or less, masonry veneer under construction shall be protected and maintained at a temperature greater than 32 degrees F for a period of 48 hours after installation. The proposed method of maintaining the temperature within the specified range shall be submitted for approval prior to implementation. No units shall be laid on a surface having a film of frost or water.

#### 3.10.4 Tolerances

Masonry shall be laid plumb, level and true to line within the tolerances specified in TABLE 1. All masonry corners shall be square unless otherwise indicated on the drawings.

TABLE 1

Variation From Plumb

---

|                    |          |
|--------------------|----------|
| In adjacent units  | 1/8 inch |
| In 10 feet         | 1/4 inch |
| In 20 feet         | 3/8 inch |
| In 40 feet or more | 1/2 inch |

Variation From Level Or Grades

---

|                    |          |
|--------------------|----------|
| In 10 feet         | 1/8 inch |
| In 20 feet         | 1/4 inch |
| In 40 feet or more | 1/2 inch |

Variation From Linear Building Lines

---

|                    |          |
|--------------------|----------|
| In 20 feet         | 1/2 inch |
| In 40 feet or more | 3/4 inch |

Variation From Cross Sectional Dimensions Of Walls

---

|       |          |
|-------|----------|
| Plus  | 1/2 inch |
| Minus | 1/4 inch |

3.10.5 Mixing of Mortar

Mortar shall be mixed in a mechanically operated mortar mixer for at least 3 minutes but not more than 5 minutes. Measurement of ingredients for mortar shall be by volume. Measurement of sand shall be accomplished by the use of a container of known capacity or shovel count based on a container of known capacity. Water shall be mixed with the dry ingredients in sufficient amount to provide a workable mixture which will adhere to the vertical surfaces of the masonry units. Mortar that has stiffened because of loss of water through evaporation shall be retempered by adding water to restore the proper consistency and workability. Mortar that has reached its initial set or that has not been used within 2-1/2 hours shall be discarded.

3.10.6 Cutting and Fitting

Wherever possible, full units shall be used in lieu of cut units. Where cut units are required to accommodate the design, cutting shall be done by masonry mechanics using power masonry saws. Wet-cut units shall be dried to the same surface-dry appearances of uncut units before being placed in the work. Cut edges shall be clean, true and sharp. Openings to accommodate pipes, conduits, and other accessories shall be neatly formed so that framing or escutcheons required will completely conceal the cut edges. Insofar as practicable, all cutting and fitting shall be accomplished while masonry work is being erected.

#### 3.10.7 Masonry Units

When being laid, masonry units shall have suction sufficient to hold the mortar and to absorb water from the mortar, but shall be damp enough to allow the mortar to remain in a plastic state to permit the unit to be leveled and plumbed immediately after being laid without destroying bond. Masonry units with frogging shall be laid with the frog side down and better or face side exposed to view. Masonry units that are cored, recessed or otherwise deformed may be used in sills or in other areas except where deformations will be exposed to view.

#### 3.10.8 Mortar Joints

Mortar joint widths shall be uniform and such that the specified widths are maintained throughout. Joints shall be of thickness equal to the difference between the actual and nominal dimensions of the masonry units in either height or length but in no case shall the joints be less than 1/4 inch nor more than 1/2 inch wide. Joints shall be tooled slightly concave.

Tooling shall be accomplished when mortar is thumbprint hard and in a manner that will compress and seal the mortar joint and produce joints of straight and true lines free of tool marks.

#### 3.10.9 Joint Reinforcement

Unless otherwise shown, joint reinforcement shall be spaced at 16 inches on center vertically. Joint reinforcement shall not be placed in the same masonry course as veneer anchors unless the anchors are designed to accommodate the wire. Joint reinforcement shall be placed so that longitudinal wires are centered in the veneer wythe for solid units. Longitudinal wires shall be fully embedded in mortar for their entire length. Splices in joint reinforcement shall be lapped a minimum of 6 inches. Joint reinforcement must be discontinuous at all veneer joints. The minimum cover for joint reinforcement is 5/8 inches.

#### 3.10.10 Veneer Joints

Brick expansion joints shall be provided at the locations shown on the drawings. Details of joints shall be as indicated on the drawings. Joints shall be clean and free of mortar and shall contain only backer rod and sealant, installed in accordance with Section 07900 JOINT SEALING. Horizontal reinforcement shall not extend through the joints.

#### 3.10.11 Weep Holes

Weep holes shall be provided at all flashing locations at intervals of 24 inches. Weep holes shall be placed in head joints just above the flashing.

Weep holes shall be formed by leaving head joints open or head joint vents may be used. Weep holes shall be kept free of mortar and other obstructions.

#### 3.10.12 Head Joint Vents

Head joint vents shall be provided near the top of the veneer wythe at the same spacing as the weep holes.

### 3.10.13 Discontinuous Work

When necessary to temporarily discontinue the work, masonry shall be stepped back for joining when work resumes. Tooothing may be used only when specifically approved. Before resuming work, loose mortar shall be removed and the exposed joint shall be thoroughly cleaned. Top of walls subjected to rain or snow shall be covered with nonstaining waterproof covering or membrane when work is not in process. Covering shall extend a minimum of 2 feet down on each side of the wall and shall be held securely in place.

### 3.10.14 Cleaning

Mortar daubs or splashings shall be completely removed from finished exposed masonry surfaces before they harden or set up. Before completion of the work, defects in mortar joints shall be raked out as necessary, filled with mortar, and tooled to match the adjacent existing mortar in the joints. The proposed cleaning method shall be done on the sample wall panel and the sample panel shall be examined for discoloration or stain. If the sample panel is discolored or stained, the method of cleaning shall be changed to ensure that the masonry surfaces in the structure will not be adversely affected. Masonry surfaces shall not be cleaned, other than removing excess surface mortar, until mortar in joints has hardened. Cleaning shall be accomplished with the use of stiff bristle fiber brushes, wooden paddles, wooden scrapers, or other suitable nonmetallic tools. The exposed brick surfaces shall be saturated with water and cleaned with a proprietary brick cleaning agent recommended by the clay products manufacturer. The cleaning agent shall not adversely affect the brick masonry surfaces. Proprietary cleaning agents shall be used in conformance with the cleaning product manufacturer's printed recommendations. Concrete masonry unit surfaces shall be dry-brushed at the end of each day's work after any required pointing has been done. Efflorescence or other stains shall be removed in conformance with the recommendations of the masonry unit manufacturer. After construction and cleaning, masonry surfaces shall be left clean, free of mortar daubs, stain, and discolorations, including scum from cleaning operations, and will have tight mortar joints throughout. Metallic tools and brushes shall not be used for cleaning.

### 3.11 BUILDING EXPANSION JOINTS

Expansion joints shall be located where indicated and shall be of the size and details shown.

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SECTION 04900

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**05/97**

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CEGS-04900 (May 1997)

Includes changes through Notice 1 (January 2001)

## SECTION 04900

### CLEANING OF MASONRY 05/97

#### PART 1 GENERAL

##### 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

##### ACI INTERNATIONAL (ACI)

ACI Compilation 20 (1993) Repair and Rehabilitation II

##### AMERICAN CONFERENCE OF GOVERNMENTAL INDUSTRIAL HYGIENISTS (ACGIH)

ACGIH Limit Values (1999) Threshold Limit Values for Chemical Substances and Physical Agents Biological Exposure Indices

##### AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 3399 (1981; R 1992e1) General-Purpose Synthetic Detergent Liquid

ASTM STP 935 (1992) Cleaning Stone and Masonry

##### 1.2 GENERAL REQUIREMENTS

Work shall be done in conformance with ACI Compilation 20. Non-historic masonry work, including materials, procedures, and requirements shall conform to Section 04200 MASONRY, except as otherwise specified herein.

###### 1.2.1 Cleaning Methods

The cleaning methods, and materials selected for a specific structure, shall be submitted for approval before work starts, and shall take into account the total construction system of the building to be worked upon, including different masonry and mortar materials, as well as non-masonry elements which may be affected by the work.

###### 1.2.2 Ionic Cleaners



Ionic chemical cleaners shall be used as specified, in accordance with the manufacturer's instructions, and only upon the direction of the Contracting Officer. Ionic cleaners shall be used only after gentler cleaning methods have been determined to be ineffective through the use of test panels.

### 1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

#### SD-03 Product Data

Cleaning Methods; G,RE.

Descriptive narrative in cleaning and repair methods to be employed in the work. Description shall be organized in sequence from preparation through completion of the work. Schedule showing estimated time, in calendar days, for completion of each phase of the work shall be included.

#### SD-07 Certificates

Materials.

Certificates of compliance attesting that the materials, equipment, and cleaning agents (chemicals, detergents, etc.) to be used in the work meet the specified requirements.

### 1.4 QUALIFICATIONS

The Contractor shall provide qualified workers, trained and experienced in restoration of masonry in historic structures, and shall furnish documentation of 5 consecutive years of work of this type. A list of similar jobs shall be provided identifying when, where, and for whom the work was done.

### 1.5 EQUIPMENT AND TECHNIQUES DEMONSTRATION

Equipment and techniques of operation shall be demonstrated in an approved location and shall be subject to approval. Dependable and sufficient equipment, appropriate and adequate to accomplish the work specified, shall be assembled at the work site in sufficient lead time before the start of the work to permit inspection, calibration of weighing and measuring devices, adjustment of parts, and the making of any repairs that may be required. The equipment shall be maintained in good working condition throughout the project.

#### 1.5.1 Cleaning Equipment

Cleaning equipment shall not cause staining, erosion, marring, or other damage or changes in the appearance of the surfaces to be cleaned.

1.5.1.1 Omitted

1.5.1.2 Water Blasting

Water blasting equipment shall include a trailer-mounted water tank, pumps, high-pressure hose, wand with safety release cutoff control, nozzle, and auxiliary water re-supply equipment. The equipment shall not be operated at a pressure which will cause etching or other damage to the masonry surface or mortar joints. The equipment shall be operated at a discharge capacity of 55 to 500 psi and 2.5 to 3 gpm for general surface cleaning operations. The water tank and auxiliary re-supply equipment shall be of sufficient capacity to permit continuous operations. The Contractor shall provide protective covers and barriers as required to prevent over-spray onto adjacent surfaces.

1.6 OMITTED

1.7 OMITTED

1.8 STORAGE OF MATERIALS

Materials shall be stored in weathertight structures which will exclude moisture and contaminants. Detergents, masonry cleaners, and other chemicals used for masonry cleaning shall be in sealed containers that legibly show the designated name, formula or specification number, quantity, date of manufacture, manufacturer's formulation number, manufacturer's directions including any warnings and special precautions, and name of manufacturer.

1.9 SAFETY AND HEALTH

Work shall comply with applicable federal, state, and local laws and regulations, and with the ACCIDENT PREVENTION PLAN, including the Activity Hazard Analysis, specified in the CONTRACT CLAUSES. The Activity Hazard Analysis shall include analyses of the potential impact of cleaning operations on personnel and on others involved in and adjacent to the work zone.

1.9.1 Worker Exposures

Exposure of workers to chemical substances shall not exceed the limits established by ACGIH Limit Values, or those required by a more stringent applicable regulation.

1.9.2 Training

Workers having access to an affected work area shall be informed of the contents of the applicable material safety data sheets, of potential health and safety hazard, and of protective controls associated with materials used on the project. An affected work area is one which may receive dust, mists, and odors from the surface preparation operations. Workers involved in masonry cleaning shall be trained in the safe handling and application, and the exposure limit, of each material to be used in the project. Personnel having a need to use respirators and masks shall be instructed in

the use and maintenance of such equipment.

#### 1.9.3 Coordination

Work shall be coordinated to minimize exposure of building occupants, other Contractor personnel, and visitors to mists and odors from surface preparation, cleaning, and repair operations.

#### 1.10 PROTECTION

Persons, motor vehicles, adjacent surfaces, surrounding buildings, equipment, and landscape materials shall be protected from chemicals used and runoff from cleaning and paint removal operations. Temporary protection covers, which shall remain in operation during the course of the work, shall be erected over pedestrian walkways and at personnel and vehicular points of entrance and exit.

##### 1.10.1 Interior Protection

The interior of buildings shall be protected from the weather, cleaning, and repair operations at all times.

##### 1.10.2 Environmental Protection

The work shall comply with the requirements of Sections 01355ENVIRONMENTAL PROTECTION.

#### 1.11 WEATHER LIMITATIONS

Materials to be used in the work shall be neither produced nor placed during periods of rain or other precipitation. Material placements shall be stopped, and all in-place material shall be protected from exposure, during periods of rain or other precipitation.

#### 1.12 WARRANTIES

##### 1.12.1 Cleaning Warranty

Cleaning procedures shall be warranted for a period of two years against harm to substrate (masonry and mortar) or to adjacent materials including, but not limited to, discoloration of substrate from improper procedures or usage, chemical damage from inadequate rinse procedures, and abrasive damage from improper procedures.

#### PART 2 PRODUCTS

##### 2.1 OMITTED

##### 2.2 CLEANING MATERIALS

###### 2.2.1 Omitted

###### 2.2.2 Detergent Cleaners

Detergent cleaners shall be in accordance with ASTM D 3399.

#### 2.2.3 Ionic Cleaners

##### 2.2.3.1 Alkaline Prewash Cleaner

Alkaline prewash cleaners shall be as recommended by the manufacturer.

##### 2.2.3.2 One-Part Masonry Cleaner

One-part masonry cleaners shall be the standard, acid formulation recommended by the manufacturer.

##### 2.2.3.3 Omitted

##### 2.2.3.4 Omitted

##### 2.2.3.5 Omitted

#### 2.2.4 Liquid Strippable Masking Agent

Liquid strippable masking agent shall be manufacturer's standard liquid, film-forming, strippable masking material for protecting glass, metal, and polished stone surfaces from the damaging effect of acidic and alkaline masonry cleaners.

#### 2.2.5 Spray Equipment

Spray equipment for chemical cleaners shall be low-pressure tanks or chemical pumps suitable for chemical cleaner indicated, and shall be equipped with stainless steel, cone-shaped spray-tip. Spray equipment for water shall disperse water through a fan-shaped spray tip at an angle of not less than 15 degrees. Spray equipment shall deliver water at a pressure not greater than 500 psi and at a volume between 2.5 and 3 gpm. Spray equipment for heated water shall be capable of maintaining temperature, at flow rates indicated, between 140 and 180 degrees F.

#### 2.2.6 Cleaning Implements

Brushes shall have natural or nylon fiber bristles only. Wire brushes shall not be used. Scrapers and application paddles shall be made of wood with rounded edges. Metallic tools shall not be used.

#### 2.2.7 Water

Potable water shall be obtained from a local source and shall be filtered to remove minerals resulting in a neutral pH, prior to application. Backflow prevention devices shall be provided at the point of connection to the water supply.

### PART 3 EXECUTION

#### 3.1 OMITTED

#### 3.2 MASONRY CLEANING

Cleaning shall conform to ASTM STP 935. Open joints shall be temporarily caulked or otherwise protected to prevent water and cleaner intrusion into the interior of the structure from pressure spraying. Non-masonry materials and severely deteriorated masonry shall be protected by approved methods prior to initiation of cleaning operations. Masonry cleaning shall remove all organic and inorganic contaminants from the surface and pores of the substrate, returning the masonry to its natural color. Surfaces shall be evenly cleaned with no evidence of streaking or bleaching. The cleaning process shall not affect the density, porosity, or color of the masonry or mortar. Cleaned masonry shall have a neutral pH. Test patches shall be made to determine a satisfactory cleaning result. Cleaning shall proceed in an orderly manner, working from top to bottom of each scaffold width and from one end of each elevation to the other. Cleaning shall be performed in a manner which results in uniform coverage of all surfaces, including corners, moldings, interstices and which produces an even effect without streaking or damage to masonry. The cleaning materials, equipment, and methods shall not result in staining, erosion, marring, or other damage to the surfaces of the structure. Following an initial inspection and evaluation of the structure and surfaces, the structure shall be given a surface cleaning. The cleaning shall provide for the complete cleaning of all exterior masonry surfaces of the structures, removing all traces of moss, dirt, and other contaminants. The following sequence of methods shall be used to determine the least aggressive, effective cleaning method:

1. Water with brushes.
2. Water with mild soap.
3. Water with stronger soap.
4. Water with stronger soap plus ammonia.
5. Stronger chemical cleaners, to be used only if any of the above methods is determined to be ineffective by the Contracting Officer.

#### 3.2.1 Project Conditions

Masonry surfaces shall be cleaned only when air temperatures are above 40 degrees F and will remain so until masonry has dried out, but for not less than 7 days after completion of the work.

#### 3.2.2 Chemical Cleaners

Acidic chemical cleaners shall not be used on concrete and other calcareous (calcium containing) masonry materials. If chemical cleaners are used on such materials, they shall be alkaline based and utilized with neutralizing afterwashes.

#### 3.2.3 Test Patches

The materials, equipment, and methods to be used in cleaning shall be demonstrated in a test section approximately 3 by 3 ft square. The location of the test section, and the completed test section shall be subject to approval. The cleaning process shall be adjusted as required and the test section rerun until an acceptable process is obtained. Test patches shall be located in inconspicuous areas of the building. The areas tested shall exhibit soiling characteristics representative of those larger areas to be cleaned. Tests shall also be conducted on areas to be stripped

of paint. Tested areas shall be allowed to dry before a determination is made on the effectiveness of a particular treatment.

3.2.4 Omitted

3.2.5 Water Cleaning

3.2.5.1 Pressure Spraying

Water shall be spray applied to masonry surfaces to comply with requirements indicated by test patches for location, purpose, water temperature, pressure, volume, and equipment. Unless otherwise indicated, the surface washing shall be done with clean, low pressure water (pressure of less than 55 psi and 2.5 to 3 gpm discharge) and the spray nozzle shall not be held less than 12 inches from surface of masonry. Water shall be applied side to side in overlapping bands to produce uniform coverage.

3.2.5.2 Handscrubbing

Pre-wetted surfaces shall be scrubbed using hand-held natural bristle or nylon brushes. Wire brushes shall not be used. Surfaces to be cleaned shall be scrubbed to remove surface contaminants.

3.2.5.3 Rinsing

Scrubbed surfaces shall be rinsed clean of all contaminants and cleaning solutions with water in a low-to-moderate pressure spray, working upwards from bottom to top of each treated area. The rinsing cycle shall remove all traces of contaminants and cleaning solutions.

3.2.6 Chemical Cleaning

Chemical cleaning of masonry shall use the gentlest means possible to achieve the desired result as determined by test patches. Chemical cleaning shall be the use of any product in addition to water, including detergents, ammonia, and bleach. Cleaning shall proceed in an orderly manner, working from top to bottom of each scaffold width and from one end of each elevation to the other. Cleaning shall result in uniform coverage of all surfaces, including corners, moldings, interstices and shall produce an even effect without streaking or damage to masonry. Chemical cleaners shall not be applied to the same masonry surfaces more than twice.

3.2.6.1 Surface Prewetting

Masonry surfaces to be cleaned with chemical cleaners shall be wetted with water using a low pressure spray before application of any cleaner.

3.2.6.2 Omitted

3.2.6.3 Alkaline Chemical Cleaning - Prewash Phase

Alkaline chemical cleaners shall be applied according to manufacturer's instructions. Alkaline cleaners shall be applied to masonry surfaces by low pressure spray 50 psi max., roller, or brush. Cleaner shall remain on

masonry surface for the time period recommended by the manufacturer. Manual scrubbing by brushes shall be employed as indicated by test patches for the specific location. Cleaned surfaces shall be rinsed with a low-to-moderate pressure spray of water.

#### 3.2.6.4 Alkaline Chemical Cleaning - Afterwash Phase

Immediately after rinsing of alkaline cleaned surfaces, a neutralizing afterwash shall be applied to the cleaned masonry areas. Neutralizing afterwash shall be applied according to manufacturer's instructions. Neutralizing afterwash shall be applied to masonry surfaces by low pressure spray 50 psi max., roller, or brush. Afterwash shall remain on masonry surface for the time period recommended by manufacturer. Cleaned surfaces shall be rinsed with a low-to-moderate pressure spray of water to remove all traces of chemical cleaners.

#### 3.2.6.5 pH Testing

Masonry surfaces which have been chemically cleaned shall be pH tested using pH monitoring pencils or papers. Chemically cleaned masonry shall be rinsed of all chemical residues until a neutral pH (7) reading is obtained from the masonry surface.

#### 3.3 OMITTED

#### 3.4 OMITTED

#### 3.5 OMITTED

#### 3.6 OMITTED

#### 3.7 OMITTED

#### 3.8 OMITTED

#### 3.9 PROTECTION OF WORK

Work shall be protected against damage from subsequent operations.

#### 3.10 DEFECTIVE WORK

Defective work shall be repaired or replaced, as directed, using approved procedures.

#### 3.11 FINAL INSPECTION

Following completion of the work, the structure shall be inspected for damage, staining, and other distresses. The patches shall be inspected for cracking, crazing, delamination, unsoundness, staining and other defects. The finish, texture, color and shade, and surface tolerances of the patches shall be inspected to verify that all requirements have been met. Surfaces exhibiting defects shall be repaired as directed.

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**09/97**

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CEGS-05120 (September 1997)

Includes changes through Notice 3 (November 1999)

SECTION 05120

STRUCTURAL STEEL

**09/97**

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN INSTITUTE OF STEEL CONSTRUCTION (AISC)

|                          |   |
|--------------------------|---|
| AISC FCD                 | (1995a) Quality Certification Program Description   |
| AISC ASD Manual          | (1989) Manual of Steel Construction Allowable Stress Design   |
| AISC Design Guide No. 10 | (1989) Erection Bracing of Low-Rise Structural Steel Frames   |
| AISC LRFD Vol I          | (1995) Manual of Steel Construction Load & Resistance Factor Design, Vol I: Structural Members, Specifications & Codes  |
| AISC LRFD Vol II         | (1995) Manual of Steel Construction Load & Resistance Factor Design, Vol II: Structural Members, Specifications & Codes |
| AISC Pub No. S303        | (1992) Code of Standard Practice for Steel Buildings and Bridges  |

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

|                 |   |
|-----------------|---|
| ASTM A 6/A 6M   | (1998a) General Requirements for Rolled Structural Steel Bars, Plates, Shapes, and Sheet Piling |
| ASTM A 36/A 36M | (1997a) Carbon Structural Steel   |
| ASTM A 307      | (1997) Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength                                |

ASTM A 500 (1999) Cold-Formed Welded and Seamless  
Carbon Steel Structural Tubing in Rounds  
and Shapes

ASTM A 992/A 992M (1998e1) Steel for Structural Shapes For  
Use in Building Framing

ASTM F 844 (1998) Washers, Steel, Plain (Flat),  
Unhardened for General Use

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

ASME B46.1 (1995) Surface Texture (Surface Roughness,  
Waviness, and Lay)

AMERICAN WELDING SOCIETY (AWS)

AWS A2.4 (1998) Standard Symbols for Welding,  
Brazing and Nondestructive Examination

AWS D1.1 (1998) Structural Welding Code - Steel

STEEL STRUCTURES PAINTING COUNCIL (SSPC)

SSPC Paint 25 (1991) Red Iron Oxide, Zinc Oxide, Raw  
Linseed Oil and Alkyd Primer (without Lead  
and Chromate Pigments)

1.2 GENERAL REQUIREMENTS

Structural steel fabrication and erection shall be performed by an organization experienced in structural steel work of equivalent magnitude. The Contractor shall be responsible for correctness of detailing, fabrication, and for the correct fitting of structural members. Connections, for any part of the structure not shown on the contract drawings, shall be considered simple shear connections and shall be designed and detailed in accordance with pertinent provisions of AISC ASD Manual and AISC LRFD Vol II. Substitution of sections or modification of connection details will not be accepted unless approved by the Contracting Officer. AISC LRFD Vol I and AISC LRFD Vol II shall govern the work. Welding shall be in accordance with AWS D1.1; except that welding for critical applications shall be in accordance with paragraph WELDING. High-strength bolting shall be in accordance with AISC LRFD Vol I.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Structural Steel System; G, AE  
Structural Connections; G, AE

Shop and erection details including members (with their connections) not shown on the contract drawings. Welds shall be indicated by standard welding symbols in accordance with AWS A2.4.

SD-03 Product Data

Welding

WPS not prequalified.

Welding

WPS prequalified.

SD-07 Certificates

Mill Test Reports

Certified copies of mill test reports for structural steel, structural bolts, nuts, washers and other related structural steel items, including attesting that the structural steel furnished contains no less than 25 percent recycled scrap steel and meets the requirements specified, prior to the installation.

Welder Qualifications

Certified copies of welder qualifications test records showing qualification in accordance with AWS D1.1.

Welding Inspector

Welding Inspector qualifications.

Fabrication

A copy of the AISC certificate indicating that the fabrication plant meets the specified structural steelwork category.

1.4 STORAGE

Material shall be stored out of contact with the ground in such manner and location as will minimize deterioration.

1.5 WELDING INSPECTOR

Welding Inspector qualifications shall be in accordance with AWS D1.1

PART 2 PRODUCTS

## 2.1 STRUCTURAL STEEL

### 2.1.1 Carbon Grade Steel

Carbon grade steel shall conform to ASTM A 36/A 36M.

### 2.1.2 Omitted

### 2.1.3 Omitted

### 2.1.4 Omitted

### 2.1.5 Omitted

### 2.1.6 Omitted

### 2.1.7 Structural Shapes for Use in Building Framing

Wide flange shapes in accordance with ASTM A 992/A 992M shall be used where indicated on the drawings.

## 2.2 STRUCTURAL TUBING

Structural tubing shall conform to ASTM A 500, Grade B.

### 2.3 OMITTED

### 2.4 OMITTED

## 2.5 HIGH STRENGTH BOLTS AND NUTS

High strength bolts shall conform to ASTM A 325, Type 1 with carbon steel nuts conforming to ASTM A 563, Grade C.

## 2.6 CARBON STEEL ANCHOR BOLTS AND NUTS

Carbon steel anchor bolts shall conform to ASTM A 307, Grade A with carbon steel nuts conforming to ASTM A 563, Grade A.

## 2.7 NUTS DIMENSIONAL STYLE

Carbon steel nuts shall be Hex style when used with ASTM A 307 bolts or Heavy Hex style when used with .

## 2.8 WASHERS

Plain washers shall conform to ASTM F 844. Other types, when required, shall conform to .

## 2.9 PAINT

Paint shall conform to SSPC Paint 25.

## PART 3 EXECUTION

### 3.1 FABRICATION

Fabrication shall be in accordance with the applicable provisions of AISC ASD Manual. Fabrication and assembly shall be done in the shop to the greatest extent possible. The fabricating plant shall be certified under the AISC FCD for Category A structural steelwork. Compression joints depending on contact bearing shall have a surface roughness not in excess of 500 micro inches as determined by ASME B46.1, and ends shall be square within the tolerances for milled ends specified in ASTM A 6/A 6M. Structural steelwork, except surfaces of steel to be encased in concrete, surfaces to be field welded, surfaces to be fireproofed, and contact surfaces of friction-type high-strength bolted connections shall be prepared for painting in accordance with endorsement "P" of AISC FCD and primed with the specified paint.

### 3.2 ERECTION

- a: Erection of structural steel, except as indicated in item b. below, shall be in accordance with the applicable provisions of AISC LRFD Vol I endorsement F of AISC FCD. Erection plan shall be reviewed, stamped and sealed by a structural engineer licensed by the state in which the project is located.
- b. For low-rise structural steel buildings ( 60 feet tall or less and a maximum of 2 stories), the erection plan shall conform to AISC Pub No. S303 and the structure shall be erected in accordance with AISC Design Guide No. 10.

#### 3.2.1 Structural Connections

Anchor bolts and other connections between the structural steel and foundations shall be provided and shall be properly located and built into connecting work. Field welded structural connections shall be completed before load is applied.

#### 3.2.2 Base Plates and Bearing Plates

Column base plates for columns and bearing plates for beams, girders, and similar members shall be provided. Base plates and bearing plates shall be provided with full bearing after the supported members have been plumbed and properly positioned, but prior to placing superimposed loads. Separate setting plates under column base plates will not be permitted. The area under the plate shall be damp-packed solidly with nonshrink grout is indicated on the drawings. Grout shall be as specified in Section 03300, "Cast-In-Place Structural Concrete."

#### 3.2.3 Field Priming

After erection, the field bolt heads and nuts, field welds, and any abrasions in the shop coat shall be cleaned and primed with paint of the same quality as that used for the shop coat.

### 3.3 WELDING

The contractor shall develop and submit the Welding Procedure Specifications (WPS) for all welding, including welding done using prequalified procedures. Prequalified procedures may be submitted for information only; however, procedures that are not prequalified shall be submitted for approval.

-- End of Section --

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SECTION 05210

STEEL JOISTS

**11/88**

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- 1.2 SUBMITTALS
- 1.3 DESCRIPTION
- 1.4 DELIVERY AND STORAGE

PART 2 PRODUCTS

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- 2.3 OMITTED
- 2.4 ACCESSORIES AND FITTINGS
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PART 3 EXECUTION

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CEGS-05210 (November 1988)

Includes changes through Notice 6 (March 2000)

SECTION 05210

STEEL JOISTS

11/88

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

STEEL JOIST INSTITUTE (SJI)

|                    |   |
|--------------------|---|
| SJI Specs & Tables | (1994) Standard Specifications Load Tables and Weight Tables for Steel Joists and Joist Girders |
|--------------------|---|

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Steel Joists

Detail drawings shall include fabrication and erection details, specifications for shop painting, and identification markings of joists.

SD-07 Certificates

Steel Joists; G, RE

Certificates stating that the steel joists have been designed and manufactured in accordance with SJI Specs & Tables. Complete engineering design computations may be submitted in lieu of the certification.

1.3 DESCRIPTION

Steel joists are designated on the drawings in accordance with the standard



designations of the Steel Joist Institute. Joists of other standard designations or joists with properties other than those shown may be substituted for the joists designated provided the structural properties are equal to or greater than those of the joists shown and provided all other specified requirements are met.

#### 1.4 DELIVERY AND STORAGE

Materials shall be delivered to the site in undamaged condition and stored off the ground in a well drained location, protected from damage, and easily accessible for inspection and handling.

### PART 2 PRODUCTS

#### 2.1 OPEN WEB STEEL JOISTS

Open web steel joists shall conform to SJI Specs & Tables, K-Series. Joists shall be designed to support the loads given in the standard load tables of SJI Specs & Tables.

#### 2.2 OMITTED

#### 2.3 OMITTED

#### 2.4 ACCESSORIES AND FITTINGS

Accessories and fittings, including end supports and bridging, shall be in accordance with the standard specifications under which the members were designed.

#### 2.5 SHOP PAINTING

Joists and accessories shall be shop painted with a rust-inhibiting primer paint. For joists which will be finish painted under Section 09900 PAINTING, GENERAL, the primer paint shall be limited to a primer which is compatible with the specified finish paint.

### PART 3 EXECUTION

#### 3.1 ERECTION

Installation of joists shall be in accordance with the standard specification under which the member was produced. Joists shall be handled in a manner to avoid damage. Damaged joists shall be removed from the site, except when field repair is approved and such repairs are satisfactorily made in accordance with the manufacturer's recommendations. Joists shall be accurately set, and end anchorage shall be in accordance with the standard specification under which the joists were produced. For spans over 40 ft through 60 ft one row of bridging nearest midspan shall be bolted diagonal bridging; for spans over 60 ft bolted diagonal bridging shall be used instead of welded horizontal bridging. Joist bridging and anchoring shall be secured in place prior to the application of any construction loads. Any temporary loads shall be distributed so that the carrying capacity of any joist is not exceeded. Loads shall not be applied

to bridging during construction or in the completed work. Abraded, corroded, and field welded areas shall be cleaned and touched up with the same type of paint used in the shop painting.

-- End of Section --

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SECTION 05300

STEEL DECKING

10/89

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- 1.3 DELIVERY, STORAGE, AND HANDLING

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CEGS-05300 (October 1989)

Includes changes through Notice 12 (June 1999)

SECTION 05300

STEEL DECKING

**10/89**

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN IRON AND STEEL INSTITUTE (AISI)

AISI Cold-Formed Mnl (1996) Cold-Formed Steel Design Manual

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 611 (1997) Structural Steel (SS), Sheet, Carbon, Cold-Rolled

ASTM A 653/A 653M (1997) Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process

ASTM A 780 (1993a) Repair of Damaged and Uncoated Areas of Hot-Dipped Galvanized Coatings

ASTM A 792/A 792M (1997) Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process

ASTM C 423 (1990a) Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method

ASTM E 795 (1993) Mounting Test Specimens During Sound Absorption Tests

AMERICAN WELDING SOCIETY (AWS)

AWS D1.3 (1998) Structural Welding Code - Sheet Steel

STEEL DECK INSTITUTE (SDI)

SDI Diaphragm Mnl (1987; Amended 1991) Diaphragm Design

Manual

SDI Pub No 29

(1995) Design Manual for Composite Decks,  
Form Decks, Roof Decks, and Cellular Metal  
Floor Deck with Electrical Distribution

STEEL STRUCTURES PAINTING COUNCIL (SSPC)

SSPC Paint 20

(1991) Zinc-Rich Primers (Type I -  
Inorganic and Type II - Organic)

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Deck Units; G, RE  
Accessories; G, RE  
Attachments  
Holes and Openings

Drawings shall include type, configuration, structural properties, location, and necessary details of deck units, accessories, and supporting members; size and location of holes to be cut and reinforcement to be provided; location and sequence of welded connections; and the manufacturer's erection instructions.

SD-03 Product Data

Deck Units; G, RE

Design computations for the structural properties of the deck units or SDI certification that the units are designed in accordance with SDI specifications.

Attachments

Prior to welding operations, copies of qualified procedures and lists of names and identification symbols of qualified welders and welding operators.

SD-07 Certificates

Deck Units  
Attachments

Manufacturer's certificates attesting that the decking material meets the specified requirements. Manufacturer's certificate attesting that the operators are authorized to use the

low-velocity piston tool.

### 1.3 DELIVERY, STORAGE, AND HANDLING

Deck units shall be delivered to the site in a dry and undamaged condition, stored off the ground with one end elevated, and stored under a weathertight covering permitting good air circulation. Finish of deck units shall be maintained at all times by using touch-up paint whenever necessary to prevent the formation of rust.

## PART 2 PRODUCTS

### 2.1 DECK UNITS

Deck units shall conform to SDI Pub No 29. Panels of maximum possible lengths shall be used to minimize end laps. Deck units shall be fabricated in lengths to span 3 or more supports with flush, telescoped, or nested 2 inchlaps at ends, and interlocking, or nested side laps, unless otherwise indicated. Deck with cross-sectional configuration differing from the units indicated may be used, provided that the properties of the proposed units, determined in accordance with AISI Cold-Formed Mnl, are equal to or greater than the properties of the units indicated and that the material will fit the space provided without requiring revisions to adjacent materials or systems.

#### 2.1.1 Roof Deck

Steel deck used in conjunction with insulation and built-up roofing shall conform to ASTM A 792/A 792M, ASTM A 611 or ASTM A 792/A 792M. Roof deck units shall be fabricated of the steel design thickness required by the design drawings and shall be zinc-coated in conformance with ASTM A 653/A 653M, G90 coating class or aluminum-zinc coated in accordance with ASTM A 792/A 792M Coating Designation AZ55.

#### 2.1.2 Acoustical Deck Units

Deck shall have a noise reduction coefficient as measured in accordance with ASTM C 423 using ASTM E 795 Mounting Type F-25. Sound absorbing materials shall be either glass fiber in roll or premolded form for acoustical steel deck (noncellular) and or glass fiber rigid strip for acoustical steel deck (cellular) in accordance with manufacturer's standards.

#### 2.1.3 Omitted

#### 2.1.4 Omitted

#### 2.1.5 Sump Pans

Sump pans shall be provided for roof drains and shall be minimum 0.075 inch thick steel, flat type. Sump pans shall be shaped to meet roof slope by the supplier or by a sheet metal specialist. Bearing flanges of sump pans shall overlap steel deck a minimum of 3 inches. Opening in bottom of pan shall be shaped, sized, and reinforced to receive roof drain.

## 2.2 TOUCH-UP PAINT

Touch-up paint for zinc-coated units shall be an approved galvanizing repair paint with a high-zinc dust content. Welds shall be touched-up with paint conforming to SSPC Paint 20 in accordance with ASTM A 780 whenever necessary to prevent the formation of rust.

## 2.3 ADJUSTING PLATES

Adjusting plates or segments of deck units shall be provided in locations too narrow to accommodate full-size units. As far as practical, the plates shall be the same thickness and configuration as the deck units.

## 2.4 CLOSURE PLATES

### 2.4.1 Closure Plates for Roof Deck

Voids above interior walls shall be closed with sheet metal where shown. Open deck cells at parapets, end walls, eaves, and openings through roofs shall be closed with sheet metal. Sheet metal shall be same thickness as deck units.

### 2.4.2 Omitted

#### 2.4.2.1 Cover Plates to Close Panels

Cover plates to close panel edge and end conditions and where panels change direction or abut.

#### 2.4.2.2 Column Closures to Close Openings

Column closures to close openings between steel deck and structural steel columns.

#### 2.4.2.3 Sheet Metal

Where deck is cut for passage of pipes, ducts, columns, etc., and deck is to remain exposed, provide a neatly cut sheet metal collar to cover edges of deck. Do not cut deck until after installation of supplemental supports.

## 2.5 ACCESSORIES

The manufacturer's standard accessories shall be furnished as necessary to complete the deck installation. Metal accessories shall be of the same material as the deck and have minimum design thickness as follows: saddles, 0.0474 inch; welding washers, 0.0598 inch; cant strip, 0.0295 inch; other metal accessories, 0.0358 inch; unless otherwise indicated. Accessories shall include but not be limited to saddles, welding washers, cant strips, butt cover plates, underlapping sleeves, and ridge and valley plates.

## PART 3 EXECUTION

### 3.1 ERECTION

Erection of deck and accessories shall be in accordance with SDI Diaphragm Mnl and the approved detail drawings. Damaged deck and accessories including material which is permanently stained or contaminated, with burned holes or deformed shall not be installed. The deck units shall be placed on secure supports, properly adjusted, and aligned at right angles to supports before being permanently secured in place. The deck shall not be used for storage or as a working platform until the units have been secured in position. Loads shall be distributed by appropriate means to prevent damage during construction and to the completed assembly. The maximum uniform distributed storage load shall not exceed the design live load. There shall be no loads suspended directly from the steel deck.

### 3.2 OMITTED

### 3.3 ATTACHMENTS

The roof deck units shall be welded with nominal 5/8 inch diameter puddle welds or fastened with screws, powder-actuated fasteners or pneumatically driven fasteners to supports as indicated on the design drawings and in accordance with requirements of SDI Pub No 29. All welding of steel deck shall be in accordance with AWS D1.3 using methods and electrodes as recommended by the manufacturer of the steel deck being used. Welds shall be made only by operators previously qualified by tests prescribed in AWS D1.3 to perform the type of work required. Welding washers shall be used at the connections of the deck to supports. Welding washers shall not be used at sidelaps. Holes and similar defects will not be acceptable. Deck ends shall be lapped. All partial or segments of deck units shall be attached to structural supports in accordance with Section 2.5 of SDI Diaphragm Mnl. Powder-actuated fasteners shall be driven with a low-velocity piston tool by an operator authorized by the manufacturer of the piston tool. Pneumatically driven fasteners shall be driven with a low-velocity fastening tool and shall comply with the manufacturer's recommendations.

### 3.4 HOLES AND OPENINGS

All holes and openings required shall be coordinated with the drawings, specifications, and other trades. Holes and openings shall be drilled or cut, reinforced and framed as indicated on the drawings or described in the specifications and as required for rigidity and load capacity. Holes and openings less than 6 inches across require no reinforcement. Holes and openings 6 to 12 inches across shall be reinforced by 0.0474 inchthick steel sheet at least 12 inches wider and longer than the opening and be fastened to the steel deck at each corner of the sheet and at a maximum of 6 inches on center. Holes and openings larger than 12 inches shall be reinforced by steel angles installed perpendicular to the steel joists and supported by the adjacent steel joists. Steel angles shall be installed perpendicular to the deck ribs and shall be fastened to the angles perpendicular to the steel joists. Openings must not interfere with seismic members such as chords and drag struts.

### 3.5 PREPARATION OF FIRE-PROOFED SURFACES



Deck surfaces, both composite and noncomposite, which are to receive sprayed-on fireproofing, shall be galvanized and shall be free of all grease, mill oil, paraffin, dirt, salt, and other contaminants which impair adhesion of the fireproofing. Any required cleaning shall be done prior to steel deck installation using a cleaning method that is compatible with the sprayed-on fireproofing.

-- End of Section --

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DIVISION 05 - METALS

SECTION 05450

PRE-ENGINEERED LIGHT GAUGE STEEL TRUSSED FRAMES

**09/97**

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- 1.1 SCOPE
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- 1.3 FABRICATOR'S QUALIFICATIONS
- 1.4 SUBMITTALS
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PART 3 EXECUTION

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SAVH-05450 (09/97)

SECTION 05450

PRE-ENGINEERED LIGHT GAUGE STEEL TRUSSED FRAMES  
**09/97**

PART 1 GENERAL

1.1 SCOPE

The work under this section consists of furnishing and installing all pre-engineered light gauge trusses as shown on drawings and as specified herein including headers, outriggers, supplemental rafters and incidental framing for a complete assembly within the extent shown on the drawings.

Pre-engineered light gauge steel trusses include planar structural units consisting of welded, screwed or bolted connected members which are fabricated, cut and assembled prior to delivery or at the job site.

Types of prefabricated trusses include:

- Gable-shaped trusses.
- Monopitch trusses.
- Supplemental headers, studs and other incidental framed assemblies.

1.2 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

|            |  |
|------------|--|
| ASTM A 446 | (1989) Specification for Steel sheet, Zinc Coated (Galvanized) by the Hot-Dip Process, Physical (Structural) Quality<br>Grade A, $F_y = 230 \text{ MPa (33 ksi)}$ : 1.21 mm (18 gauge) and lighter<br>Grade D, $F_y = 345 \text{ MPa (50 ksi)}$ : 1.52 mm (16 gauge) and heavier<br>Galvanizing: G60 coating class |
|------------|--|

1.3 FABRICATOR'S QUALIFICATIONS

Trusses shall be designed, fabricated, and erected by a firm which has a record including a minimum of 5 years of successfully fabricating trussed assemblies similar to scope required and which practices a quality control program which includes inspection by an independent inspection and testing

agency.

#### 1.4 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

##### SD-03 Product Data

###### Product Data

Submit fabricator's technical data covering materials, shapes, hardware, fabrication process, handling and erection.

##### SD-02 Shop Drawings

###### Shop Drawings; G,AE

Submit shop drawings showing shapes and dimensions of members to be used including pitch, span, camber configuration and spacing for each type or configuration of truss required. Show all bearing and anchorage details. Specify and detail all supplemental strapping, bracing clips and other accessories required for proper installation. Shop drawings shall include all placement sequences and instructions.

##### SD-06 Test Reports

###### Design Analysis; G,AE

To the extent engineering design considerations are indicated as fabricator's responsibility, submit design analysis and test reports indicating loading, section properties, allowable stress, stress diagrams and calculations, and similar information needed for analysis and to ensure trusses comply with requirements. All designs shall bear the name and seal of a structural engineer licensed to practice in the state where trusses are to be erected.

##### SD-07 Certificates

###### Certificate of Compliance

Submit certificate, signed by an officer of fabricating firm, indicating trusses and related assemblies to be supplied for this project comply with all indicated requirements.

#### 1.5 DELIVERY, STORAGE AND HANDLING

Handle and store truss materials and accessories, and in accordance with manufacturer's instructions to avoid damage from bending, overturning or other cause for which truss is not designed to resist or endure. Storage shall be off-ground in a dry ventilated space or protect with waterproof

coverings.

Time fabrication and erection of trusses to avoid extended on-site storage and to avoid delaying work of other trades whose work must follow erection of trusses.

## PART 2 PRODUCTS

### 2.1 FRAMING COMPONENTS

#### 2.1.1 Available Manufacturer

Subject to compliance with requirements, framing shapes and components for pre-engineered light gauge prefabricated steel trusses shall be as manufactured or recommended by approved manufacturer.

#### 2.1.2 Design, Analysis and Computation

Design, analysis, and computation of section properties shall be in conformance with the specification for the Design of Cold-Formed Steel Structural Members of the American Iron and Steel Institute.

#### 2.1.3 Galvanized Structural Members

All galvanized structural members shall be formed from steel that corresponds to the requirements of ASTM A 446, Grade A (minimum yield of 33 ksi) for (18 gauge) steel or lighter and ASTM A 446, Grade D (minimum yield of 50 ksi) for (16 gauge) or heavier.

#### 2.1.4 Steel Members

All steel members shall be galvanized with a G60 coating minimum. All truss top and bottom chord members and rafters shall be 16 gauge minimum.

### 2.2 FASTENERS

Framing components shall be fastened to each other by screws or welding as recommended by approved manufacturer.

## PART 3 EXECUTION

### 3.1 FABRICATION

Light gauge steel prefabricated trusses shall be fabricated either on or off site prior to erection.

All metal framing shall be erected in accordance with the current printed instructions of the approved subcontractor or his fabricator.

All framing components shall be straight and true prior to fabrication. Flattening or straightening of components shall be done by a process not

injurious to materials.

All framing components shall be cut neatly to fit squarely against abutting members.

No splices will be allowed in trusses except at joints.

Provide all angles, clips, and other miscellaneous pieces necessary to attach light gauge framing panels to building structure or to attach other materials to light gauge framing panels.

All components shall be set square in line and shall be held firmly in position until properly fastened.

All panel components shall be joined by screws or welding.

Finished assemblies shall be free from twists, bends, kinks, or open joints with all members straight, square, and true to line.

### 3.2 ERECTION

Prefabricated trusses shall be braced against racking. Lifting of trusses shall be done so as to not cause local distortion in any member.

All light gauge steel framing shall be erected by approved methods using equipment of adequate capacity to safely perform the work.

The Contractor is responsible for checking dimensions and assuring fit of all members and panels before erection begins.

All work shall be erected plumb and level and to dimensions, spacings and elevations indicated on drawings.

Members shall be of size and spacing shown on the approved shop drawings.

Provide web stiffeners and reinforcement at reaction points where required by analysis or to suit details.

Hoist units in place by means of lifting equipment suited to sizes and types of trusses required, applied at designated lift points as recommended by fabricator, exercising care not to damage truss members or joists by out-of-plane end or other causes.

Provide temporary bracing as required to maintain trusses plumb, parallel and in location indicated, until permanent bracing is installed.

Anchor trusses securely at all bearing points to comply with methods and details indicated.

Install permanent bracing and related components to enable trusses to maintain design spacing, withstand live and dead loads including lateral loads, and to comply with other indicated requirements.

Do not cut or remove truss members.

-- End of Section --

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SECTION 05500

MISCELLANEOUS METAL

**07/97**

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- 2.24 SAFETY NOSING
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- 2.27 OMITTED
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- 3.8 OMITTED
- 3.9 OMITTED
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- 3.11 OMITTED
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-- End of Section Table of Contents --

SECTION 05500

MISCELLANEOUS METAL  
**07/97**

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

ALUMINUM ASSOCIATION (AA)

AA DAF-45 (1997) Designation System for Aluminum  
Finishes

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 53/A 53M (1999b) Pipe, Steel, Black and Hot-Dipped,  
Zinc-Coated, Welded and Seamless

ASTM A 123/A 123M (1997a) Zinc (Hot-Dip Galvanized)  
Coatings on Iron and Steel Products

ASTM A 446 (1989) Specification for Steel sheet, Zinc  
Coated (Galvanized) by the Hot-Dip Process,  
Physical (Structural) Quality  
Grade A,  $F_y = 230$  MPa (33 ksi): 1.21 mm  
(18 gauge) and lighter  
Grade D,  $F_y = 345$  MPa (50 ksi): 1.52 mm  
(16 gauge) and heavier  
Grade E,  $F_y = 550$  MPa (80 ksi)  
Galvanizing: G60 and G90 coating class

ASTM A 653/A 653M (1999a) Steel Sheet, Zinc-Coated  
(Galvanized) or Zinc-Iron Alloy-Coated  
(Galvannealed) by the Hot-Dip Process

ASTM A 924/A 924M (1999) General Requirements for Steel  
Sheet, Metallic-Coated by the Hot-Dip  
Process

ASTM B 26/B 26M (1999) Aluminum-Alloy Sand Castings

ASTM B 429 (1995) Aluminum-Alloy Extruded Structural  
Pipe and Tube

ASTM E 814 (1997) Fire Tests of Through-Penetration  
Fire Stops

AMERICAN WELDING SOCIETY (AWS)

AWS D1.1 (2000) Structural Welding Code - Steel

COMMERCIAL ITEM DESCRIPTIONS (CID)

CID A-A-344 (Rev B) Lacquer, Clear Gloss, Exterior,  
Interior

## 1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

### SD-02 Shop Drawings

Miscellaneous Metal Items.

Detail drawings indicating material thickness, type, grade, and class; dimensions; and construction details. Drawings shall include catalog cuts, erection details, manufacturer's descriptive data and installation instructions, and templates. Detail drawings for the following items: Gates, handrails, metal support rods, fire extinguisher cabinet.

### SD-04 Samples

Miscellaneous Metal Items.

Samples of the following items: Expansion joint covers, safety nosings. Samples shall be full size, taken from manufacturer's stock, and shall be complete as required for installation in the structure. Samples may be installed in the work, provided each sample is clearly identified and its location recorded.

## 1.3 GENERAL REQUIREMENTS

The Contractor shall verify all measurements and shall take all field measurements necessary before fabrication. Welding to or on structural steel shall be in accordance with AWS D1.1. Items specified to be galvanized, when practicable and not indicated otherwise, shall be hot-dip galvanized after fabrication. Galvanizing shall be in accordance with ASTM A 123/A 123M, ASTM A 653/A 653M, or ASTM A 924/A 924M, as applicable. Exposed fastenings shall be compatible materials, shall generally match in color and finish, and shall harmonize with the material to which fastenings are applied. Materials and parts necessary to complete each item, even though such work is not definitely shown or specified, shall be included.

Poor matching of holes for fasteners shall be cause for rejection. Fastenings shall be concealed where practicable. Thickness of metal and details of assembly and supports shall provide strength and stiffness. Joints exposed to the weather shall be formed to exclude water.

#### 1.4 DISSIMILAR MATERIALS

Where dissimilar metals are in contact, or where aluminum is in contact with concrete, mortar, masonry, wet or pressure-treated wood, or absorptive materials subject to wetting, the surfaces shall be protected with a coat of bituminous paint or asphalt varnish.

#### 1.5 WORKMANSHIP

Miscellaneous metalwork shall be well formed to shape and size, with sharp lines and angles and true curves. Drilling and punching shall produce clean true lines and surfaces. Welding shall be continuous along the entire area of contact except where tack welding is permitted. Exposed connections of work in place shall not be tack welded. Exposed welds shall be ground smooth. Exposed surfaces of work in place shall have a smooth finish, and unless otherwise approved, exposed riveting shall be flush. Where tight fits are required, joints shall be milled. Corner joints shall be coped or mitered, well formed, and in true alignment. Work shall be accurately set to established lines and elevations and securely fastened in place. Installation shall be in accordance with manufacturer's installation instructions and approved drawings, cuts, and details.

#### 1.6 ANCHORAGE

Anchorage shall be provided where necessary for fastening miscellaneous metal items securely in place. Anchorage not otherwise specified or indicated shall include slotted inserts made to engage with the anchors, expansion shields, and power-driven fasteners when approved for concrete; toggle bolts and through bolts for masonry; machine and carriage bolts for steel; and lag bolts and screws for wood.

#### 1.7 ALUMINUM FINISHES

Unless otherwise specified, aluminum items shall have anodized finish. The thickness of the coating shall be not less than that specified for protective and decorative type finishes for items used in interior locations or architectural Class I type finish for items used in exterior locations in AA DAF-45. Items to be anodized shall receive a polished satin finish. Aluminum surfaces to be in contact with plaster or concrete during construction shall be protected with a field coat conforming to CID A-A-344.

#### 1.8 SHOP PAINTING

Surfaces of ferrous metal except galvanized surfaces, shall be cleaned and shop coated with the manufacturer's standard protective coating unless otherwise specified. Surfaces of items to be embedded in concrete shall not be painted. Items to be finish painted shall be prepared according to manufacturer's recommendations or as specified.

PART 2 PRODUCTS

- 2.1 OMITTED
- 2.2 OMITTED
- 2.3 OMITTED
- 2.4 OMITTED
- 2.5 OMITTED
- 2.6 OMITTED

2.7 PIPE GUARDS (BOLLARDS)

Pipe guards shall be heavy duty steel pipe conforming to ASTM A 53/A 53M, Type E or S, weight STD, black finish.

2.8 DOWNSPOUT BOOTS

Downspout boots shall be cast iron with receiving bells sized to fit downspouts.

2.9 EXPANSION JOINT COVERS

Expansion joint covers shall be constructed of extruded aluminum with anodized satin finish for walls and ceilings. Plates, backup angles, expansion filler strip and anchors shall be designed as indicated. Expansion joint system shall provide a 1/4 inch movement.

- 2.10 OMITTED
- 2.11 OMITTED
- 2.12 OMITTED
- 2.13 OMITTED

2.14 HANDRAILS

Handrails shall be designed to resist a concentrated load of 200 pounds in any direction at any point of the top of the rail or 20 pounds per foot applied horizontally to top of the rail, whichever is more severe.

2.14.1 Omitted

2.14.2 Aluminum Handrails

Handrails shall consist of 1-1/2 inch nominal Schedule 40 pipe ASTM B 429. Railings and pipe collars shall be anodized natural color. All fasteners shall be Series 300 stainless steel.

a. Jointing shall be by one of the following methods:

- (1) Flush type rail fittings, welded and ground smooth with splice locks secured with 3/8 inch recessed head setscrews.
- (2) Mitered and welded joints, made by fitting post to top rail and intermediate rail to post and corners, shall be groove welded and ground smooth. Splices, where allowed by the Contracting

Officer, shall be butted and reinforced by a tight fitting dowel or sleeve not less than 6 inches in length. Dowel or sleeve shall be connected to one side of the splice by tack welding or by using epoxy cement.

(3) Railings shall be assembled using slip-on aluminum-magnesium alloy fittings for joints. Fittings shall be fastened to pipe or tube with 1/4 inch or 3/8 inch stainless steel recessed head setscrews. Assembled railings shall be provided with fittings only at vertical supports or at rail terminations attached to walls. Expansion joints shall be at the midpoint of panels. A setscrew shall be provided in only one side of the slip-on sleeve. Alloy fittings shall conform to ASTM B 26/B 26M.

- 2.15 OMITTED
- 2.16 OMITTED
- 2.17 OMITTED
- 2.18 OMITTED

#### 2.19 MISCELLANEOUS

Miscellaneous plates and shapes for items that do not form a part of the structural steel framework, such as lintels, sill angles, miscellaneous mountings, and frames, shall be provided to complete the work.

- 2.20 OMITTED
- 2.21 OMITTED
- 2.22 OMITTED
- 2.23 OMITTED

#### 2.24 SAFETY NOSING

Safety nosings shall be of cast aluminum with plain, abrasive surface. Nosing shall be 3 inches wide and terminating at not more than 6 inches from the ends of treads, except nosing for metal pan cement-filled treads shall extend the full length of the tread. Safety nosings shall be provided with anchors not less than 3/4 inch long. Integrally cast mushroom anchors are not acceptable.

- 2.25 OMITTED
- 2.26 OMITTED
- 2.27 OMITTED
- 2.28 OMITTED
- 2.29 OMITTED
- 2.30 OMITTED
- 2.31 OMITTED
- 2.32 OMITTED
- 2.33 OMITTED

#### 2.34 FIRE EXTINGUISHER CABINETS

Cabinets to be located in fire-rated walls shall be fire-rated type, fabricated in accordance with ASTM E 814, and shall be listed by an approved testing agency for 1- and 2-hour combustible and non-combustible

wall systems. The testing agency's seal shall be affixed to each fire-rated cabinet. Cabinets shall be of the recessed type suitable for 10 pound extinguishers. Box and trim shall be of heavy gage rolled steel. Door shall be a rigid frame with full length piano type hinge and double strength (DSA) glass panel. Door and panel shall have the manufacturer's standard white baked enamel finish inside and out.

## 2.35 GATES

Gates for mechanical equipment enclosure shall as far as practicable, match the existing gates. Gates shall be constructed of roll-formed hat-shaped pickets assembled on either side of a horizontal rail system, including diagonal bracing for swing gates.

### 2.35.1 Vertical Panels

Vertical panels shall be 5 inches wide by 1-1/4 inches deep after forming. Material shall be ASTM A 446 Grade E steel, 0.170 inch thick minimum, hot dip galvanized to G90 Class.

### 2.35.2 Frame Members

Frame members shall be 0.074 inch thick steel cold-formed channels, 1-1/4 by 1-1/2 inches. Top channel shall be same material as vertical panels.

### 2.35.3 Posts and Hardware

Posts shall be ASTM A 53 steel pipe, nominal 4 inch diameter, Schedule 40, galvanized, with cast or ductile iron top cap. Hinges shall be manufacturer's standard for size of gate. Each leaf shall be provided with drop rod, configured to accept padlock accessible from outside the enclosure.

#### 2.35.3.1 Finishes

Finishes of all components shall be factory applied 2-coat fluoropolymer, 1.0 mil total thickness. Color shall be as indicated.

#### 2.35.3.2 Design Standard

Gate shall be similar and equivalent to Privacy Panel Gate by ROHN.

## 2.36 METAL SUPPORT RODS

Metal support rods for equipment lockers shall be fabricated from satin stainless steel or bright chromium plated brass rod or tubing, 3/4 inch diameter, size and configuration indicated. Rod shall be fitted by swaging, welding or other secure means into a flange of matching material that can be screwed or bolted to the back panel of equipment lockers and support a point load of 50 pounds at the free end of the rod and 200 pounds distributed along the length of the rod. Hollow tubing, if used, shall have a stainless steel or chromium plated brass plug welded into the open end.

PART 3 EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

All items shall be installed at the locations shown and according to the manufacturer's recommendations. Items listed below require additional procedures as specified.

3.2 OMITTED

3.3 OMITTED

3.4 OMITTED

3.5 INSTALLATION OF PIPE GUARDS (BOLLARDS)

Pipe guards shall be set vertically in concrete piers. Piers shall be constructed of, and the hollow cores of the pipe filled with, concrete specified in SECTION 03300 CAST-IN-PLACE STRUCTURAL CONCRETE.

3.6 INSTALLATION OF DOWNSPOUT BOOTS

Downspouts shall be secured to building through integral lips with appropriate fasteners.

3.7 ATTACHMENT OF HANDRAILS

Brackets shall be installed where indicated. Splices, where required, shall be made at expansion joints. Removable sections shall be installed as indicated.

3.7.1 OMITTED

3.7.2 Installation of Aluminum Handrails

Installation shall be by means of core drilled holes in concrete, filled with epoxy grout. Where aluminum or alloy fittings or extrusions are to be in contact with dissimilar metals or portland cement concrete, the contact surface shall be given a heavy coating of bituminous paint or asphalt varnish.

3.8 OMITTED

3.9 OMITTED

3.10 OMITTED

3.11 OMITTED

3.12 OMITTED

3.13 INSTALLATION OF SAFETY NOSINGS

Nosing shall be completely embedded in concrete before the initial set of the concrete occurs and shall finish flush with the top of the concrete surface.

3.14 OMITTED

3.15 OMITTED

3.16 OMITTED



- 3.17 OMITTED
- 3.18 OMITTED
- 3.19 OMITTED

3.20 INSTALLATION OF FIRE EXTINGUISHER CABINETS

Metal fire extinguisher cabinets shall be furnished and installed where shown on the drawings or specified.

3.21 INSTALLATION OF GATES AND GATE POSTS

Posts shall be set 3 feet deep into concrete footings. Gates shall be fastened to posts in accordance with the manufacturer's instructions. Gates shall be straight, plumb and true and shall operate freely without dragging or binding.

3.22 INSTALLATION OF METAL SUPPORT RODS

Screw flanges into back of equipment lockers as shown. Rods shall be level and firmly fixed.

-- End of Section --

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SECTION 06100

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CEGS-06100 (September 1996)

Includes changes through Notice 6 (May 2000)

SECTION 06100

ROUGH CARPENTRY

**09/96**

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN FOREST & PAPER ASSOCIATION (AF&PA)

AF&PA T01 (1991; Supple 1993; Addenda Apr 1997;  
Supple T02) National Design Specification  
for Wood Construction

AF&PA T11 (1988) Manual for Wood Frame Construction

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 307 (1997) Carbon Steel Bolts and Studs, 60  
000 PSI Tensile Strength

ASTM C 518 (1998) Steady-State Heat Flux Measurements  
and Thermal Transmission Properties By  
Means of the Heat Flow Meter Apparatus

ASTM C 553 (1992) Mineral Fiber Blanket Thermal  
Insulation for Commercial and Industrial  
Applications

ASTM C 665 (1998) Mineral-Fiber Blanket Thermal  
Insulation for Light Frame Construction  
and Manufactured Housing

ASTM C 1136 (1995) Flexible, Low Permeance Vapor  
Retarders for Thermal Insulation

ASTM E 96 (1995) Water Vapor Transmission of  
Materials

ASTM E 154 (1988; R 1999) Water Vapor Retarders Used  
in Contact with Earth Under Concrete  
Slabs, on Walls, or as Ground Cover

ASTM F 547 (1977; R 1995) Definitions of Terms  
Relating to Nails for Use with Wood and  
Wood-Base Materials

AMERICAN WOOD-PRESERVERS' ASSOCIATION (AWPA)

AWPA C2 (1995) Lumber, Timber, Bridge Ties and  
Mine Ties - Preservative Treatment by  
Pressure Processes

AWPA C9 (1997) Plywood - Preservative Treatment by  
Pressure Processes

AWPA M4 (1996) Standard for the Care of  
Preservative-Treated Wood Products

AWPA P5 (1997) Standards for Waterborne  
Preservatives

APA - THE ENGINEERED WOOD ASSOCIATION (APA)

APA PRP-108 (1980; Rev Jan 1996) Performance Standards  
and Policies for Structural-Use Panels

CALIFORNIA REDWOOD ASSOCIATION (CRA)

CRA RIS-01-SS (1997) Standard Specifications for Grades  
of California Redwood Lumber

DEPARTMENT OF COMMERCE (DOC)

DOC PS 1 (1996) Voluntary Product Standard -  
Construction and Industrial Plywood

DOC PS 2 (1992) Performance Standards for  
Wood-Based Structural-Use Panels

FACTORY MUTUAL ENGINEERING AND RESEARCH (FM)

FM LPD 1-49 (1995) Loss Prevention Data Sheet -  
Perimeter Flashing

NATIONAL HARDWOOD LUMBER ASSOCIATION (NHLA)

NHLA Rules (1994) Rules for the Measurement &  
Inspection of Hardwood & Cypress

NORTHEASTERN LUMBER MANUFACTURERS ASSOCIATION (NELMA)

NELMA Grading Rules (1997) Standard Grading Rules for  
Northeastern Lumber

SOUTHERN CYPRESS MANUFACTURERS ASSOCIATION (SCMA)

SCMA Specs (1986; Supple No. 1, Aug 1993) Standard  
Specifications for Grades of Southern  
Cypress

SOUTHERN PINE INSPECTION BUREAU (SPIB)

SPIB Rules (1994; Supple 8 thru 11) Standard Grading  
Rules for Southern Pine Lumber

WEST COAST LUMBER INSPECTION BUREAU (WCLIB)

WCLIB Std 17 (1996; Supples VII(A-E), VIII(A-C))  
Grading Rules for West Coast Lumber

WESTERN WOOD PRODUCTS ASSOCIATION (WWPA)

WWPA Grading Rules (1999) Western Lumber Grading Rules 95

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-07 Certificates

Grading and Marking

Manufacturer's certificates (approved by an American Lumber Standards approved agency) attesting that lumber and material not normally grade marked meet the specified requirements. Certificate of Inspection for grade marked material by an American Lumber Standards Committee (ALSC) recognized inspection agency prior to shipment.

Insulation

Certificate attesting that the glass and mineral fiber insulation furnished for the project contains recovered material, and showing an estimated percent of such recovered material.

1.3 DELIVERY AND STORAGE

Materials shall be delivered to the site in undamaged condition, stored off ground in fully covered, well ventilated areas, and protected from extreme changes in temperature and humidity.

PART 2 PRODUCTS

2.1 LUMBER AND SHEATHING

#### 2.1.1 Grading and Marking

##### 2.1.1.1 Lumber Products

Solid sawn and finger-jointed lumber shall bear an authorized gradestamp or grademark recognized by ALSC, or an ALSC recognized certification stamp, mark, or hammerbrand. Surfaces that are to be exposed to view shall not bear grademarks, stamps, or any type of identifying mark. Hammer marking will be permitted on timbers when all surfaces will be exposed to view.

##### 2.1.1.2 Omitted

##### 2.1.1.3 Plywood and Other Sheathing Products

Materials shall bear the grademark or other identifying marks indicating grades of material and rules or standards under which produced, including requirements for qualifications and authority of the inspection organization. Except for plywood and wood structural panels, bundle marking will be permitted in lieu of marking each individual piece. Surfaces that are to be exposed to view shall not bear grademarks or other types of identifying marks.

#### 2.1.2 Sizes

Lumber and material sizes shall conform to requirements of the rules or standards under which produced. Unless otherwise specified, lumber shall be surfaced on four sides. Unless otherwise specified, sizes indicated are nominal sizes, and actual sizes shall be within manufacturing tolerances allowed by the standard under which the product is produced.

#### 2.1.3 Treatment

Exposed areas of treated wood that are cut or drilled after treatment shall receive a field treatment in accordance with AWP A M4. Items of all-heart material of cedar, cypress, or redwood will not require preservative treatment, except when in direct contact with soil. Except as specified for all-heart material of the previously mentioned species, the following items shall be treated:

- a. Wood members in contact with or within 18 inches of soil.
- b. Wood members in contact with water.
- c. Wood members exposed to the weather including those used in builtup roofing systems or as nailing strips or nailers over fiberboard or gypsum-board wall sheathing as a base for wood siding.
- d. Wood members set into concrete regardless of location, including flush-with-deck wood nailers for roofs.
- e. Wood members in contact with concrete that is in contact with soil or water or that is exposed to weather.

##### 2.1.3.1 Lumber

Lumber shall be treated in accordance with AWPA C2 with waterborne preservatives listed in AWPA P5 to a retention level as follows:

- a. 0.25 pcf intended for above ground use.
- b. 0.40 pcf intended for ground contact and fresh water use.

#### 2.1.3.2 Plywood

Plywood shall be treated in accordance with AWPA C9 with waterborne preservatives listed in AWPA P5 to a retention level as follows:

- a. 0.25 pcf intended for above ground use.
- b. 0.40 pcf intended for ground contact and fresh water use.

#### 2.1.4 Moisture Content

At the time lumber and other materials are delivered and when installed in the work their moisture content shall be as follows:

- a. Treated and Untreated Lumber: 4 inches or less, nominal thickness, 19 percent maximum. 5 inches or more, nominal thickness, 23 percent maximum in a 3 inch perimeter of the timber cross-section.
- b. Materials Other Than Lumber: In accordance with standard under which product is produced.

#### 2.1.5 Omitted

#### 2.1.6 Omitted

##### 2.1.6.1 Omitted

##### 2.1.6.2 Omitted

##### 2.1.6.3 Omitted

#### 2.1.7 Sheathing

Sheathing shall be plywood.

##### 2.1.7.1 Omitted

##### 2.1.7.2 Omitted

##### 2.1.7.3 Plywood

Plywood shall conform to DOC PS 1, APA PRP-108 or DOC PS 2, Grade C-D or sheathing grade with exterior glue. Sheathing for roof and walls without corner bracing of framing shall have a span rating of 16/0 or greater for supports 16 inches on center and a span rating of 24/0 or greater for supports 24 inches on center.

#### 2.1.8 Omitted

#### 2.1.9 Omitted

#### 2.1.10 Omitted

#### 2.1.11 Omitted



#### 2.1.12 Miscellaneous Wood Members

##### 2.1.12.1 Nonstress Graded Members

Members shall include bridging, corner bracing, furring, grounds, and nailing strips. Members shall be in accordance with TABLE I for the species used. Sizes shall be as follows unless otherwise shown:

| Member         | Size (inch)  |
|----------------|--|
| Bridging       | 1 x 3 or 1 x 4 for use between members 2 x 12 and smaller; 2 x 4 for use between members larger than 2 x 12. |
| Corner bracing | 1 x 4.   |
| Furring        | 1 x 2.   |
| Grounds        | Plaster thickness by 1-1/2.  |
| Nailing strips | 1 x 3 or 1 x 4 when used as shingle base or interior finish, otherwise 2 inch stock.                         |

2.1.12.2 Omitted

2.1.12.3 Omitted

##### 2.1.12.4 Blocking

Blocking shall be standard or number 2 grade.

##### 2.1.12.5 Rough Bucks and Frames

Rough bucks and frames shall be straight standard or number 2 grade.

#### 2.2 ACCESSORIES AND NAILS

Markings shall identify both the strength grade and the manufacturer. Accessories and nails shall conform to the following:

##### 2.2.1 Anchor Bolts

ASTM A 307, size as indicated, complete with nuts and washers.

##### 2.2.2 Bolts: Lag, Toggle, and Miscellaneous Bolts and Screws

Type, size, and finish best suited for intended use. Finish options include zinc compounds, cadmium, and aluminum paint impregnated finishes.

##### 2.2.3 Clip Angles

Steel, 3/16 inch thick, size best suited for intended use; or zinc-coated

steel or iron commercial clips designed for connecting wood members.

#### 2.2.4 Expansion Shields

Type and size best suited for intended use.

2.2.5 Omitted

2.2.6 Omitted

Optional to wood bridging; zinc-coated steel, size and design to provide rigidity equivalent to specified wood bridging.

#### 2.2.7 Nails and Staples

ASTM F 547, size and type best suited for purpose; staples shall be as recommended by the manufacturer of the materials to be joined. For sheathing and subflooring, length of nails shall be sufficient to extend 1 inch into supports. In general, 8-penny or larger nails shall be used for nailing through 1 inch thick lumber and for toe nailing 2 inch thick lumber; 16-penny or larger nails shall be used for nailing through 2 inch thick lumber. Nails used with treated lumber and sheathing shall be galvanized. Nailing shall be in accordance with the recommended nailing schedule contained in AF&PA T11. Where detailed nailing requirements are not specified, nail size and spacing shall be sufficient to develop an adequate strength for the connection. The connection's strength shall be verified against the nail capacity tables in AF&PA T01. Reasonable judgement backed by experience shall ensure that the designed connection will not cause the wood to split. If a load situation exceeds a reasonable limit for nails, a specialized connector shall be used.

### 2.3 INSULATION

Thermal resistance of insulation shall be not less than the R-values shown.

R-values shall be determined at 75 degrees F in accordance with ASTM C 518.

Insulation shall contain the highest practicable percentage of recovered material which has been recovered or diverted from solid waste, but not including material reused in a manufacturing process. Where two materials have the same price and performance, the one containing the higher recovered material content shall be provided. Insulation shall be the standard product of a manufacturer and factory marked or identified with manufacturer's name or trademark and R-value. Identification shall be on individual pieces or individual packages. Materials containing more than one percent asbestos will not be allowed.

#### 2.3.1 Batt or Blanket

##### 2.3.1.1 Glass Fiber Batts and Rolls

Glass fiber batts and rolls shall conform to ASTM C 665, Type II kraft faced insulation.

##### 2.3.1.2 Mineral Fiber Batt

Mineral fiber batt shall conform to ASTM C 665, Type II kraft faced

insulation, Class C.

#### 2.3.1.3 Mineral Fiber Blanket

Mineral fiber blanket shall conform to ASTM C 553, Type I, Class 6. Blankets shall be sized to suit construction conditions, resilient type for use below and above ambient temperature to 350 degrees F. Blankets shall have a factory applied vapor-barrier facing on one side with 2 inch nailing tabs on both edges. Vapor barriers shall be fire retardant, high vapor transmission, and aluminum foil laminated to crepe paper type conforming to ASTM C 1136, Type II. Nominal density shall be 0.75 pcf.

#### 2.4 VAPOR RETARDER

Vapor retarder shall be polyethylene sheeting conforming to ASTM E 154 or other equivalent material. Vapor retarder shall have a maximum vapor permeance rating of 0.5 perms as determined in accordance with ASTM E 96, unless otherwise specified.

### PART 3 EXECUTION

#### 3.1 OMITTED

#### 3.2 INSTALLATION OF SHEATHING

##### 3.2.1 Omitted

##### 3.2.2 Omitted

##### 3.2.3 Plywood

Sheathing shall be applied with edges 1/8 inch apart at side and end joints, and nailed at supported edges at 6 inches on center and at intermediate supports 12 inches on center unless otherwise shown. Nailing of edges shall be 3/8 inch from the edges. Wall sheathing shall extend over top and bottom plates, and if applied horizontally the vertical joints shall be made over supports and staggered. Wall sheathing over which wood shingles are to be applied shall be applied horizontally. Roof sheathing shall be applied with long dimension at right angles to supports, end joints made over supports, and end joints staggered.

##### 3.3 OMITTED

##### 3.4 OMITTED

##### 3.5 OMITTED

#### 3.6 INSTALLATION OF MISCELLANEOUS WOOD MEMBERS

##### 3.6.1 Omitted

##### 3.6.2 Omitted

##### 3.6.3 Blocking

Blocking shall be provided as necessary for application of siding, sheathing, subflooring, wallboard, and other materials or building items, and to provide firestopping. Blocking for firestopping shall ensure a

maximum dimension of 8 feet for any concealed space. Blocking shall be cut to fit between framing members and rigidly nailed thereto.

#### 3.6.4 Nailers and Nailing Strips

Nailers and nailing strips shall be provided as necessary for the attachment of finish materials. Nailers used in conjunction with roof deck installation shall be installed flush with the roof deck system. Stacked nailers shall be assembled with spikes or nails spaced not more than 18 inches on center and staggered. Beginning and ending nails shall not be more than 6 inches for nailer end. Ends of stacked nailers shall be offset approximately 12 inches in long runs and alternated at corners. Anchors shall extend through the entire thickness of the nailer. Strips shall be run in lengths as long as practicable, butt jointed, cut into wood framing members when necessary, and rigidly secured in place. Nailers and nailer installation for Factory Mutual wind uplift rated roof systems specified in other Sections of these specifications shall conform to the recommendations contained in FM LPD 1-49.

#### 3.6.5 Wood Grounds

Wood grounds shall be provided as necessary for attachment of trim, finish, and other work to plaster. Grounds shall be run in lengths as long as practicable, butt jointed, and rigidly secured in place.

#### 3.6.6 Furring Strips

Furring strips shall be provided at the locations shown. Furring strips shall be installed at 16 inches on center unless otherwise shown, run in lengths as long as practicable, butt jointed and rigidly secured in place.

#### 3.6.7 Rough Bucks and Frames

Rough bucks shall be set straight, true, and plumb, and secured with anchors near top and bottom of each wood member and at intermediate intervals of not more than 3 feet. Anchors for concrete shall be expansion bolts, and anchors for masonry shall be 3/16 x 1-1/4 inch steel straps extending not less than 8 inches into the masonry and turned down 2 inches into the masonry.

#### 3.7 OMITTED

#### 3.8 INSTALLATION OF INSULATION

Insulation shall be installed after construction has advanced to a point that the installed insulation will not be damaged by remaining work. For thermal insulation the actual installed thickness shall provide the R-values shown. For acoustical insulation the installed thickness shall be as shown. Insulation shall be installed on the weather side of such items as electrical boxes and water lines. Unless otherwise specified, installation shall be in accordance with the manufacturer's recommendation.

#### 3.9 INSTALLATION OF VAPOR RETARDER

Vapor retarder shall be applied to provide a continuous barrier at window and door frames, and at all penetrations such as electrical outlets and switches, plumbing connections, and utility service penetrations. Joints in the vapor retarder shall be lapped and sealed according to the manufacturer's recommendations.

3.10 TABLES

TABLE I. SPECIES AND GRADE

| Subflooring, Roof Sheathing, Wall Sheathing, Furring |                              |                   |               |                     |               |  |
|--|------------------------------|-------------------|---------------|---------------------|---------------|--|
| Grading<br>Rules                                     | Species                      | Const<br>Standard | No. 2<br>Comm | No. 2<br>Board Comm | No. 3<br>Comm |  |
| NHLA Rules   | Cypress                      |                   |               | X                   |               |  |
| NELMA Grading Rules                                  | Northern White Cedar         |                   |               |                     | X             |  |
|  | Eastern White Pine           | X                 |               |                     |               |  |
|  | Northern Pine                | X                 |               |                     |               |  |
|  | Balsam Fir                   |                   |               |                     | X             |  |
|  | Eastern Hemlock-<br>Tamarack |                   |               |                     | X             |  |
| CRA RIS-01-SS  | Redwood                      |                   | X             |                     |               |  |
| SCMA Specs   | Cypress                      |                   |               | X                   |               |  |
| SPIB Rules   | Southern Pine                |                   | X             |                     |               |  |
| WCLIB Std 17   | Douglas Fir-Larch            | X                 |               |                     |               |  |
|  | Hem-Fir                      | X                 |               |                     |               |  |
|  | Sitka Spruce                 | X                 |               |                     |               |  |
|  | Mountain Hemlock             | X                 |               |                     |               |  |
|  | Western Cedar                | X                 |               |                     |               |  |
| WWPA Grading Rules                                   | Douglas Fir-Larch            | X                 |               |                     |               |  |
|  | Hem-Fir                      | X                 |               |                     |               |  |
|  | Idaho White Pine             | X                 |               |                     |               |  |
|  | Lodgepole Pine               |                   |               | X                   |               |  |
|  | Ponderosa Pine               |                   |               | X                   |               |  |
|  | Sugar Pine                   |                   |               | X                   |               |  |
|  | Englemann Spruce             |                   |               | X                   |               |  |
|  | Douglas Fir South            |                   |               | X                   |               |  |
|  | Mountain Hemlock             |                   |               | X                   |               |  |
|  | Subalpine Fir                |                   |               | X                   |               |  |
|  | Western Cedar                |                   |               | X                   |               |  |

TABLE II. SPECIES AND GRADE

| Wood Bumpers        |                          |       |       |
|---------------------|--------------------------|-------|-------|
| Grading Rules       | Species                  | No. 1 | No. 2 |
| NHLA Rules          | Red Oak                  | X     |       |
| NELMA Grading Rules | Northern Pine            |       | X     |
|                     | Eastern Hemlock-Tamarack |       | X     |
| SPIB Rules          | Southern Pine            | X     |       |
| WCLIB Std 17        | Douglas Fir-Larch        |       | X     |
|                     | Hem-Fir                  |       | X     |
| WWPA Grading Rules  | Douglas Fir-Larch        |       | X     |
|                     | Hem-Fir                  |       | X     |
|                     | Douglas Fir-South        |       | X     |

-- End of Section --

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**09/96**

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CEGS-06200 (September 1996)

Includes changes through Notice 3 (May 2000)

SECTION 06200

FINISH CARPENTRY

**09/96**

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

- |              |   |
|--------------|---|
| ANSI A208.1  | (1993) Wood Particleboard                             |
| ANSI B18.2.1 | (1996) Square and Hex Bolts and Screws<br>Inch Series |
| ANSI B18.6.1 | (1981; R 1997) Wood Screws (Inch Series)              |

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

- |                   |   |
|-------------------|---|
| ASME/ANSI B18.2.2 | (1987; R 1993) Square and Hex Nuts (Inch<br>Series) |
|-------------------|---|

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

- |            |   |
|------------|---|
| ASTM A 687 | (1993) High-Strength Nonheaded Steel Bolts<br>and Studs   |
| ASTM F 547 | (1977; R 1995) Definitions of Terms<br>Relating to Nails for Use with Wood and<br>Wood-Base Materials |

AMERICAN WOOD-PRESERVERS' ASSOCIATION (AWPA)

- |         |   |
|---------|---|
| AWPA M4 | (1996) Standard for the Care of<br>Preservative-Treated Wood Products |
|---------|---|

ARCHITECTURAL WOODWORK INSTITUTE (AWI)

- |               |  |
|---------------|--|
| AWI Qual Stds | (1997) Architectural Woodwork Quality<br>Standards |
|---------------|--|

BUILDERS HARDWARE MANUFACTURERS ASSOCIATION, INC. (BHMA)

ANSI/BHMA A156.9 (1994) Cabinet Hardware (BHMA 201)

CALIFORNIA REDWOOD ASSOCIATION (CRA)

CRA RIS-01-SS (1997) Standard Specifications for Grades  
of California Redwood Lumber

DEPARTMENT OF COMMERCE (DOC)

DOC PS 1 (1996) Voluntary Product Standard -  
Construction and Industrial Plywood

DOC PS 58 (1974) Basic Hardboard

HARDWOOD PLYWOOD & VENEER ASSOCIATION (HPVA)

ANSI/HPVA HP-1 (1994) Hardwood and Decorative Plywood

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA LD 3 (1995) High-Pressure Decorative Laminates

NORTHEASTERN LUMBER MANUFACTURERS ASSOCIATION (NELMA)

NELMA Grading Rules (1997) Standard Grading Rules for  
Northeastern Lumber

SOUTHERN CYPRESS MANUFACTURERS ASSOCIATION (SCMA)

SCMA Specs (1986; Supple No. 1, Aug 1993) Standard  
Specifications for Grades of Southern  
Cypress

SOUTHERN PINE INSPECTION BUREAU (SPIB)

SPIB Rules (1994;Supple 8 thru 11) Standard Grading  
Rules for Southern Pine Lumber

WEST COAST LUMBER INSPECTION BUREAU (WCLIB)

WCLIB Std 17 (1996; Supples VII(A-E), VIII(A-C))  
Grading Rules For West Coast Lumber

WESTERN WOOD PRODUCTS ASSOCIATION (WWPA)

WWPA Grading Rules (1999)Western Lumber Grading Rules 95

WOOD MOULDING AND MILLWORK PRODUCERS ASSOCIATION (WMMPA)

WMMPA WM 6 (1987) Industry Standard for Non-Pressure  
Treating of Wood Millwork

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Finish Carpentry

Drawings showing fabricated items and special mill and woodwork items. Drawings shall indicate materials and details of construction, methods of fastening, erection, and installation.

SD-04 Samples

Moldings. Fascias and Trim. Laminated plastic.

Samples shall be of sufficient size to show patterns, color ranges, and types, as applicable, of the material proposed to be used.

1.3 DELIVERY AND STORAGE

Materials shall be delivered to the site in undamaged condition, stored off ground in fully covered, well-ventilated areas, and protected from extreme changes in temperature and humidity.

PART 2 PRODUCTS

2.1 WOOD ITEMS, AND TRIM

The Contractor shall furnish products which optimize design by reducing the amount of wood used (engineered wood), or recycled wood products, and preservatives without arsenic or chromium when the products and methods are competitive in price or directed by the Contracting Officer.

2.1.1 Grading and Marking

Materials shall bear the grademark, stamp or other identifying marks indicating grades of material and rules or standards under which produced. Such identifying marks on a material shall be in accordance with the rule or standard under which the material is produced, including requirements for qualifications and authority of the inspection organization, usage of authorized identification, and information included in the identification. The inspection agency for lumber shall be certified by the Board of Review, American Lumber Standards Committee, to grade the species used. Except for plywood, wood structural panels, and lumber, bundle marking will be permitted in lieu of marking each individual piece. Surfaces that are to be architecturally exposed to view shall not bear grademarks, stamps, or other types of identifying marks.

2.1.2 Sizes and Patterns

Lumber sizes and patterns shall conform to rules or standards under which produced. Unless otherwise specified, lumber shall be surfaced on four sides. Sizes and patterns for materials other than lumber shall conform to requirements of the rules or standards under which produced. Size references, unless otherwise specified, are nominal sizes, and actual sizes shall be within manufacturing tolerances allowed by the standard under which the product is produced.

#### 2.1.3 Moisture Content

The maximum moisture content of untreated trim and wood siding shall be 15 percent at the time of delivery to the jobsite and when installed. Moisture content of all other material shall be in accordance with the standard under which the product is produced.

#### 2.1.4 Preservative Treatment

##### 2.1.4.1 Exterior Wood Molding and Millwork

Exterior wood molding and millwork within 18 inches of soil, in contact with water or concrete shall be preservative-treated in accordance with WMMPA WM 6. Exposed areas of treated wood that are cut or drilled after treatment shall receive a field treatment in accordance with AWP4 M4. Items of all-heart material of cedar, cypress, or redwood will not require preservative treatment, except when in direct contact with soil.

#### 2.1.5 Softwood Plywood

DOC PS 1, thicknesses as indicated.

##### 2.1.5.1 Plywood for Countertops

Exterior type, A-C Grade.

#### 2.1.6 Hardwood Plywood

ANSI/HPVA HP-1, Type II (Interior) Premium (A) Grade, hardwood veneer core construction, face veneers of red oak, of thickness indicated.

#### 2.1.7 Hardboard

DOC PS 58, tempered type, 1/4 inch thick.

#### 2.1.8 Particleboard

ANSI A208.1, Grade 1-M-2 or 2-M-2 or better.

#### 2.1.9 Acrylic Plastic Sheets

Acrylic plastic commercial-grade sheets shall conform to ANSI Z97.1, clear and smooth on both sides ultraviolet stabilized, scratch resistant, 0.236 in. thick.

#### 2.1.10 Fascias and Trim

#### 2.1.10.1 Wood

Trim shall be species and grade listed in TABLE I at the end of this section. Sizes shall be as indicated. Metal corners may be furnished in lieu of wood cornerboards for horizontal siding; and if furnished, shall be galvanized steel and primed or aluminum and primed.

#### 2.1.11 Woodwork Items

##### 2.1.11.1 Utility Shelving

Utility shelving shall be a suitable species equal to or exceeding requirements of No. 3 Common white fir under WWPA Grading Rules, 1 inch thick; or plywood, interior type, Grade A-B, 1/2 inch thick, any species group.

#### 2.2 NAILS

Nails shall be the size and type best suited for the purpose and shall conform to ASTM F 547. Nails shall be hot-dip galvanized or aluminum when used on exterior work. For siding, length of nails shall be sufficient to extend 1-1/2 inches into supports, including wood sheathing over framing. Screws for use where nailing is impractical shall be size best suited for purpose.

#### 2.3 LAMINATED PLASTIC

NEMA LD 3.

#### 2.4 Horizontal Surfaces

Grade GP 50, satin finish. Color and pattern shall be as indicated.

#### 2.5 Backing Sheet

BK 20.

#### 2.6 HARDWARE

Provide sizes, types, and spacings of manufactured building materials recommended by the product manufacturer except as otherwise indicated or specified. Provide hot-dipped galvanized steel or aluminum nails and fastenings where used on the exterior or exposed to the weather.

##### 2.6 Wood Screws

ANSI B18.6.1.

##### 2.7 Bolts, Nuts, Lag Screws, and Studs

ANSI B18.2.1, ASME/ANSI B18.2.2, and ASTM A 687.

##### 2.8 Adjustable Shelf Standards

ANSI/BHMA A156.9, Type B04071, with shelf rests Type B04081.

## 2.9 Vertical Slotted Shelf Standards

ANSI/BHMA A156.9, Type B04102, with shelf brackets Type B04112.

## PART 3 EXECUTION

### 3.1 OMITTED

### 3.2 OMITTED

### 3.3 EXTERIOR TRIM

Exposed surfaces and square edges shall be machine sanded, caulked, and constructed to exclude water. Joints of built-up items, in addition to nailing, shall be glued as necessary for weather-resistant construction. End joints in built-up members shall be well distributed. Joints in flat work shall be shouldered. Backs of wide-faced miters shall be held together with metal rings and glue. Fascias and other flat members shall be in maximum practicable lengths. Cornices shall be braced, blocked, and rigidly anchored for support and protection of vertical joints.

### 3.4 INTERIOR TRIM

Interior trim shall be installed straight, plumb, level and with closely fitted joints. Exposed surfaces shall be machine sanded at the mill. Molded work shall be coped at returns and interior angles and mitered at external corners. Intersections of flatwork shall be shouldered to ease any inherent changes in plane. Window and door trim shall be provided in single lengths. Blind nailing shall be used to the extent practicable, and face nailing shall be set and stopped with a nonstaining putty to match the finish applied. Screws shall be used for attachment to metal; setting and stopping of screws shall be of the same quality as required where nails are used.

### 3.5 OMITTED

### 3.6 OMITTED

### 3.7 WOODWORK ITEMS

#### 3.7.1 Quality Standards (Qual Stds)

The terms "Premium," "Custom," and "Economy" refer to the quality grades defined in AWI Qual Stds. Items not specified to be of a specific grade shall be Custom grade. The AWI Qual Stds is superseded by all contract document requirements indicated or stated herein.

#### 3.7.2 Countertops

Fabricate laminate covered countertops with lumber and a core of exterior plywood or particleboard, glued and screwed to form an integral unit. Bond laminated plastic under pressure to exposed surfaces, using type of glue recommended by plastic manufacturer, and bond a backing sheet under

pressure to underside of countertop. Countertop unit shall be squared self-edged type, cove moulding, and Style A back splash, and covered with NEMA LD 3, Grade GP 50 plastic. Back splash shall be not less than 3 1/2 inches nor more than 4 1/2 inches high.

3.7.3 Casework With Transparent Finish (CTF)

3.7.3.1 AWI Quality Grade (CTF)

Premium grade.

3.7.3.2 Construction (CTF)

Details shall conform to as indicated design.

3.7.3.3 Exposed Parts

red oak specie, plain sliced cut.

3.7.3.4 Semi-Exposed Parts

As specified in the AWI QS for the grade selected.

3.7.4 Casework With High Pressure Laminate Finish (CHPL)

3.7.4.1 AWI Quality Grade (CHPL)

Custom grade.

3.7.4.2 Construction (CHPL)

Details shall conform to flush overlay design.

3.7.4.3 Exposed Surfaces

High pressure laminate, color and pattern as indicated.

3.7.4.4 Semi-Exposed Surfaces

As specified in the AWI Qual Stds for the grade selected.

3.7.5 Shelving

Shelving shall be anchored to supporting construction. Unless otherwise indicated, shelves shall be supported by wall-supported brackets not more than 24 inches on center or as required to limit deflection to 1/4 inch between supports with a load of 35 lb per lineal foot. Adjustable shelf hardware shall be steel standards, channel shaped, with 1 inch adjustment slots and brackets designed for attachment to standards.

3.7.6 Metal Support Rods

Rods for equipment lockers are specified in Section 05500 MISCELLANEOUS METAL.



### 3.8 TABLES

TABLE I. SPECIES AND GRADE TABLES

| Grading<br>Rules    | Species           | Choice | Clear | C Select | C &<br>Better |
|---------------------|-------------------|--------|-------|----------|---------------|
| NELMA Grading Rules |                   |        |       |          |               |
|                     | Eastern Cedar     |        |       |          | X             |
|                     | Eastern Hemlock   |        | X     |          |               |
|                     | Tamarack          |        |       |          | X             |
|                     | Eastern W. Pine   |        |       |          | X             |
|                     | Northern Pine     |        |       |          | X             |
|                     | Eastern Spruce    |        |       | X        |               |
|                     | Balsam Fir        |        | X     |          |               |
| CRA RIS-01-SS       | Redwood           |        | X     |          |               |
| SCMA Specs          | Cypress           |        |       | X        |               |
| SPIB Rules          | Southern Pine     |        |       |          | X             |
| WCLIB Std 17        | Douglas Fir       |        |       |          | X             |
|                     | Larch             |        |       |          | X             |
|                     | Hemlock Fir       |        |       |          | X             |
|                     | Mountain Hemlock  |        |       |          | X             |
|                     | Sitka Spruce      |        |       |          | X             |
| WWPA Grading Rules  |                   |        |       |          |               |
|                     | Douglas Fir       |        |       |          | X             |
|                     | Larch             |        |       |          | X             |
|                     | Hemlock Fir       |        | X     |          |               |
|                     | Mountain Hemlock  |        |       |          | X             |
|                     | Western Larch     |        | X     |          |               |
|                     | Idaho White Pine  | X      |       |          |               |
|                     | Lodgepole Pine    |        | X     |          |               |
|                     | Ponderosa Pine    |        | X     |          |               |
|                     | Sugar Pine        |        | X     |          |               |
|                     | Englemann Spruce  |        | X     |          |               |
|                     | Douglas Fir South |        | X     |          |               |
|                     | Subalpine Fir     |        | X     |          |               |

NOTE 1: Western Cedar under WCLIB Std 17 shall be Grade B; and under WWPA Grading Rules, Western Cedar shall be Grade B bevel for siding and Grade A for trim.

NOTE 2: Except as specified in NOTE 3 below, exterior trim shall be any of the species listed above. Interior trim shall be Red Oak graded in accordance with AWI Qual Stds and the highest grade of the species for stain or natural finish and one grade below highest grade of species for paint finish.

NOTE 3: Southern Yellow Pine, Douglas Fir, Larch, Western Larch, and Tamarack shall not be used where painting is required and may be used on exterior work only when approved and stained with a preservative type stain.

-- End of Section --

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DIVISION 07 - THERMAL & MOISTURE PROTECTION

SECTION 07132

BITUMINOUS WATERPROOFING

09/98

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CEGS-07132 (September 1998)

Includes changes through Notice 1 (February 2001)

SECTION 07132

BITUMINOUS WATERPROOFING  
**09/98**

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

|             |  |
|-------------|--|
| ASTM C 208  | (1995) Cellulosic Fiber Insulating Board   |
| ASTM D 41   | (1994) Asphalt Primer Used in Roofing, Dampproofing, and Waterproofing           |
| ASTM D 173  | (1997b) Bitumen-Saturated Cotton Fabrics Used in Roofing and Waterproofing       |
| ASTM D 449  | (1989; R 1999e1) Asphalt Used in Dampproofing and Waterproofing                  |
| ASTM D 1327 | (1997a) Bitumen-Saturated Woven Burlap Fabrics Used in Roofing and Waterproofing |
| ASTM D 1668 | (1997a) Glass Fabrics (Woven and Treated) for Roofing and Waterproofing          |
| ASTM D 4586 | (1993; R 1999) Asphalt Roof Cement, Asbestos Free                                |

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-03 Product Data

Reinforcing Fabric  
Protection Board

Manufacturer's data including technical information which indicates full compliance with this section.

#### Applications

Manufacturer's installation instructions, before delivery of materials to the site. Instructions shall specify acceptable range of asphalt application temperatures and the maximum temperature for holding asphalt in a heated condition.

#### SD-07 Certificates

##### Materials

Certificates from manufacturer attesting that asphalt manufactured and shipped to jobsite meets the specified requirements.

### 1.3 QUALIFICATIONS

Work shall be performed by skilled laborers thoroughly experienced in the type of bituminous waterproofing work specified to meet the requirements of the contract.

### 1.4 DELIVERY, STORAGE AND HANDLING

Waterproofing materials shall be delivered to the project site in the original sealed containers bearing the name of the manufacturer, contents and brand name. Asphalt shall be protected from freezing in a weathertight enclosure. Reinforcement fabrics shall be protected from moisture damage and moisture absorption in a weathertight enclosure or shall be stored off the ground on pallets, and covered on top and all sides with breathable-type canvas tarpaulins. Plastic sheets cause condensation buildup and therefore shall not be used to cover waterproofing materials. Damaged or deteriorated materials shall be removed from project site.

## PART 2 PRODUCTS

### 2.1 ASPHALT WATERPROOFING

#### 2.1.1 Primer

Primer for hot-applied asphalt waterproofing shall conform to ASTM D 41, asbestos-free, non-fibrated, manufactured with highly ductile soft asphalts and selected hydrocarbons.

#### 2.1.2 Above-Grade Hot-Applied Asphalt

For above-grade applications where asphalt will not be exposed to temperatures exceeding 122 degrees F, hot-applied asphalt for membrane waterproofing system shall conform to ASTM D 449, Type II. For above-grade applications where asphalt will be exposed to sunlight and temperatures exceeding 122 degrees F, hot-applied asphalt shall conform to ASTM D 449,

Type III.

#### 2.1.3 Below-Grade Hot-Applied Asphalt

Hot-applied asphalt for below-grade applications shall conform to ASTM D 449, Type I, asbestos-free, manufactured from crude petroleum, suitable for use with membrane waterproofing systems.

#### 2.1.4 Reinforcement Fabrics

##### 2.1.4.1 Cotton Fabrics

Cotton fabrics shall be woven entirely of cotton conforming with ASTM D 173, thoroughly and uniformly saturated with asphalt.

##### 2.1.4.2 Woven Burlap Fabrics

Woven burlap fabrics shall be composed of 100 percent jute fiber and two cotton threads at each selvage conforming with ASTM D 1327, thoroughly and uniformly saturated with asphalt. The fabric mesh shall not be completely closed or sealed by the process of saturation. Sufficient porosity shall be maintained to allow successive moppings of the plying asphalt to seep through. The surface shall not be coated or covered with talc or any other substances that will interfere with the adhesion between fabric and plying asphalt. The fabric surface shall be uniformly smooth and free of irregularities, folds and knots. The finished woven burlap fabrics shall be free of ragged edges, untrue edges, breaks or cracks, and other visible external defects.

##### 2.1.4.3 Glass Fabrics

Glass fabrics shall conform to ASTM D 1668 Type I, asphalt-treated woven glass waterproofing fabrics coated with asphalt.

#### 2.1.5 Flashing Cement

Flashing cement shall conform to ASTM D 4586, Type I, trowel grade, asbestos free, manufactured from asphalts characterized as adhesive, healing and ductile.

### 2.2 INSULATION BOARDS

Insulation boards shall conform to ASTM C 208 cellulosic fiber boards, construction grade, 1/2 inch thick, fibrous-felted homogeneous panel. Insulation boards shall be manufactured from ligno-cellulosic fibers (wood or cane) by a felting or molding process, asphalt-saturated or coated, with a density of 10 to 31 lbs. per square foot. Surfaces of insulation boards shall be free of cracks, lumps, excessive departure from planeness, or other defects that adversely affect performance.

## PART 3 EXECUTION

### 3.1 SURFACE PREPARATION

Surfaces scheduled for bituminous waterproofing shall be prepared in accordance with waterproofing manufacturer's recommendations. Surface preparation shall be approved prior to waterproofing application.

#### 3.1.1 Protection of Surrounding Areas

Before starting the waterproofing work, the surrounding areas and surfaces shall be protected from spillage and migration of asphalt onto other work. Drains and conductors shall be protected from clogging with asphalt.

#### 3.1.2 Masonry Surfaces

Surfaces shall be free of oil, grease, dirt, laitance, loose material, frost, debris and other contaminants. Mortar joints shall be flush and free of extraneous mortar and chipped or broken masonry.

#### 3.1.3 Concrete Surfaces

Surfaces shall be properly cured, free of form release agents, oil, grease, dirt, laitance, loose material, frost, debris and other contaminants. Form ties shall be cut flush with surface. Sharp protrusions and form match lines shall be removed. Holes, voids, spalled areas and cracks which can damage waterproofing materials shall be repaired. Rough surfaces shall be parged with a well-adhering coat of cement mortar.

#### 3.1.4 Metal Surfaces

Surfaces shall be dry and be free of rust, scale, loose paint, oil, grease, dirt, frost and debris.

### 3.2 HOT-APPLIED ASPHALT WATERPROOFING

Asphalt waterproofing shall be applied when the ambient temperature is 40 degrees F or above. Heating kettles and tanks shall be provided with automatic thermostatic control capable of maintaining asphalt temperature. Controls shall be calibrated and maintained in working order for duration of work. At time of application, asphalt shall not be heated above the equiviscous temperature (EVT) recommended by manufacturer. Immediately before use, temperature shall be measured with a portable thermometer at the point of application. EVT and flashpoint temperatures of asphalt in kettle shall be conspicuously posted on kettle. Asphalt with a temperature not conforming to the manufacturer's recommendations shall be returned to the kettle. Asphalt overheated by more than 50 degrees F for more than 1 hour shall be removed from site.

#### 3.2.1 Below-Grade Wall Waterproofing

Waterproofing for foundation walls shall consist of a 2-ply hot-applied asphalt membrane system. Fabrics shall be installed using the "shingle" method. Joints shall be caulked prior to primer applications. Primer shall be applied at a rate of 1/2 gallon per 100 square feet. Fabrics shall be overlapped at ends and staggered a minimum 19 inch for 2-ply system. End-to-end taping is not acceptable. Each fabric shall be firmly embedded into a solid uniform coating of hot asphalt at a rate of 20

pounds per 100 square feet by pressing with broom. Fabrics shall not touch fabrics. Hot asphalt shall penetrate each fabric to provide the required adhesion. Asphalt between fabrics shall not be excessive to prevent slippage. Waterproofing system consisting of two or more fabrics shall be provided with fabric reinforcement at corners, angles, over construction joints, and in locations where waterproofing fabrics are subject to unusual stress.

### 3.2.2 Floor Waterproofing

Primer shall be applied at a rate of 1/2 gallon per 100 square feet. Primer shall not be left in puddles. Primer shall be dry to the touch before application of asphalt. Where slab abuts walls, first reinforcing fabric shall extend 6 inches minimum on slab and 8 inches on wall. At vertical corners, first fabric shall extend minimum 5 inches from corner on each side. Second fabric shall lap the first fabric 2 inches minimum. At floor drains, and elsewhere as indicated, the fabric shall extend into a clamping device, set in a heavy coating of flashing cement, and securely clamped.

### 3.3 FLOOD TESTING

Prior to concealment, waterproofed floors over occupied spaces shall be tested for watertightness. Drains shall be plugged and floors shall be submerged with 3 inches of clean water. Water shall be permitted to stand for a minimum of 24 hours. If leaks occur, water shall be drained and repairs made. Upon completion of repairs, floors shall be flooded with 3 inches of clean water and flood testing shall be repeated for minimum of 24 hours from the time each leak is repaired. Waterproofing system shall be completely watertight, and shall be approved in writing before covering up with other materials. Additional coats of asphalt are not an acceptable method for repairing leaks.

### 3.4 CLEAN-UP

Surfaces of other work which are stained with waterproofing materials shall be cleaned with a cleaner recommended by waterproofing manufacturer.

### 3.5 PROTECTION OF COMPLETED WORK

#### 3.5.1 Floor Waterproofing

The completed waterproofing work shall be protected from damage during and after construction. Protective covering shall be placed immediately before proceeding with the work which will conceal the waterproofing.

#### 3.5.2 Wall Waterproofing

Waterproofing against which backfill is to be placed shall be protected with a single layer of insulation board. Insulation boards shall be pressed into the final mopping while the asphalt is still hot, with edges of boards placed into moderate contact and joints staggered. For two-layer installation, joints in second layer shall be staggered over joints in first layer. Where surfaced insulation board is used, the surfaced side



shall face outward. Boards shall be carefully and neatly fitted around projections, and shall cover the entire surface of the waterproofing materials. Waterproofing system not covered with protection board shall be protected to prevent damage from subsequent building operations. Installed boards shall not remain exposed at the end of a work day.

-- End of Section --

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DIVISION 07 - THERMAL & MOISTURE PROTECTION

SECTION 07220

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**04/00**

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CEGS-07220 (April 2000)

SECTION 07220

ROOF INSULATION  
**04/00**

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI A208.1 (1999) Particleboard Mat Formed Woods

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 208 (1995) Cellulosic Fiber Insulating Board

ASTM C 578 (1995) Rigid, Cellular Polystyrene Thermal Insulation

ASTM C 726 (1993) Mineral Fiber Roof Insulation Board

ASTM C 728 (1997) Perlite Thermal Insulation Board

ASTM C 1050 (1991) Rigid Cellular Polystyrene-Cellulosic Fiber Composite Roof Insulation

ASTM C 1177/C 1177M (1996) Glass Mat Gypsum Substrate for Use as Sheathing

ASTM C 1289 (1998) Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board

ASTM D 41 (1994) Asphalt Primer Used in Roofing, Dampproofing, and Waterproofing

ASTM D 226 (1997a) Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing

ASTM D 312 (1995a) Asphalt Used in Roofing

ASTM D 2178 (1997a) Asphalt Glass Felt Used in Roofing and Waterproofing

|             |   |
|-------------|---|
| ASTM D 4586 | (1993) Asphalt Roof Cement, Asbestos Free                               |
| ASTM D 4897 | (1998) Asphalt-Coated Glass-Fiber Venting<br>Base Sheet Used in Roofing |

FACTORY MUTUAL ENGINEERING AND RESEARCH (FM)

|           |  |
|-----------|--|
| FM P9513  | (1996) Loss Prevention Data for Roofing<br>Contractors |
| FM P7825a | (1998) Approval Guide Fire Protection                  |
| FM P7825c | (1998) Approval Guide Building Materials               |

UNDERWRITERS LABORATORIES (UL)

|                |                                     |
|----------------|-------------------------------------|
| UL Bld Mat Dir | (1999) Building Materials Directory |
|----------------|-------------------------------------|

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-03 Product Data

Application of Insulation

Insulation manufacturer's recommendations for the application and installation of insulation.

Inspection

The inspection procedure for insulation installation, prior to start of roof insulation work.

SD-07 Certificates

Insulation

Certificate attesting that the expanded perlite or polyisocyanurate insulation contains recovered material and showing estimated percent of recovered material. Certificates of compliance for felt materials.

1.3 STORAGE OF MATERIALS

Insulation materials shall be stored in accordance with manufacturer's instructions. Insulation, base sheet, and felt shall be kept dry at all times, before, during, and after delivery to the site and shall be stored in an enclosed building or in a closed trailer. Wet insulation, wet base sheet or wet felt shall be permanently removed from the site. Felts shall

be stacked on end one level high. Felt rolls shall be maintained at a temperature above 50 degrees F for 24 hours immediately before laying.

#### 1.4 FIRE CLASSIFICATION

Insulation shall have been tested as part of a roof construction assembly of the type used in this project, and the construction shall be listed as Fire-Classified in UL Bld Mat Dir or Class I in FM P7825a, except for installation on poured concrete decks or precast concrete roof deck panels.

### PART 2 PRODUCTS

#### 2.1 BITUMINOUS MATERIALS

Bituminous materials shall conform to the following requirements:

##### 2.1.1 Asphalt Bitumen

ASTM D 312, Type III or IV. Asphalt flash point, finished blowing temperature, and equiviscous temperature (EVT) for mop and for mechanical spreader application shall be indicated on bills of lading or on individual containers.

##### 2.1.2 Asphalt Cement

ASTM D 4586, Type I for surfaces sloped from 0 to 3 inches per foot; Type II for slopes greater than 3 inches per foot.

##### 2.1.3 Asphalt Primer

ASTM D 41.

#### 2.2 INSULATION

Insulation shall be a standard product of the manufacturer and shall be factory marked with the manufacturer's name or trade mark, the material specification number, the R-value at 75 degrees F, and the thickness. Minimum thickness shall be as recommended by the manufacturer. Boards shall be marked individually. The thermal resistance of insulation shall be not less than the R-value shown on the drawings. The insulation manufacturing process shall not include chlorofluoro carbons (CFC) or formaldehydes. Insulation and fiberboard shall contain the highest practicable percentage of material which has been recovered or diverted from solid waste (e.g., postconsumer waste), but not including material reused in a manufacturing process. Where two materials have comparable price and performance, the one having the higher recovered material content shall be selected. Insulation shall be one, or a combination of the following materials:

##### 2.2.1 Omitted

##### 2.2.2 Composite Board Insulation

ASTM C 1050 or ASTM C 1289 Type III, or ASTM C 1289 Type VI. Perlite, in

composite board, may be replaced with ANSI A208.1 wood fiberboard, 7/16 inch minimum thickness, provided that the composite board meets specified physical requirements. Composite board with wood fiberboard shall conform to ASTM C 1289, Type V.

#### 2.2.3 Expanded-Perlite Insulation Board

ASTM C 728 with a minimum recovered material content of 23 percent of the expanded perlite portion of the board.

#### 2.2.4 Fiberboard

ASTM C 208 Type II, Grade 1 or 2, roof insulating board with a minimum recovered material content of 80 percent, treated with sizing, wax or bituminous impregnation. Bituminous impregnation shall be limited to 4 percent by weight when used over steel decks.

#### 2.2.5 Mineral-Fiber Insulation Board

ASTM C 726.

#### 2.2.6 Polyisocyanurate

ASTM C 1289, Type I, or ASTM C 1289 Type II, having minimum recovered material content of 9 percent by weight of the polyisocyanurate portion of the board.

#### 2.2.7 Polystyrene

Polystyrene shall be in accordance with ASTM C 578, Type II, IV, or X.

#### 2.2.8 Glass Mat Gypsum Roof Board

Glass mat gypsum roof board shall be in accordance with ASTM C 1177/C 1177M, flame spread - 0, smoke developed - 0, 500 psi Class A non-combustible.

### 2.3 FASTENERS

Fasteners shall be specifically designed screws and plates or spikes and plates of sufficient length to hold insulation securely in place. Fasteners shall conform to insulation manufacturer's recommendations except that holding power, when driven, shall be not less than 120 pounds each in steel deck. Fasteners for steel or concrete decks shall conform to FM P7825c for Class I roof deck construction, and shall be spaced to withstand an uplift pressure of 90 pounds per square foot.

### 2.4 VENTING INORGANIC BASE SHEET

ASTM D 4897, Type II, Non-perforated, with spot mopping holes where specified.

### 2.5 GLASS ROOFING FELT

ASTM D 2178, Type IV.

## 2.6 ORGANIC ROOFING FELT

ASTM D 226, Type I.

## 2.7 WOOD NAILERS

Wood nailers shall conform to Section 06100 ROUGH CARPENTRY, including preservative treatment. Edge nailers shall be not less than nominal 6 inches wide and of thickness to finish flush with the top surface of the insulation. Surface mounted nailers shall be a nominal 3 inches wide by the full thickness of the insulation.

## PART 3 EXECUTION

### 3.1 COORDINATION REQUIREMENTS

Insulation and roofing membrane shall be finished in one operation up to the line of termination at the end of each day's work. Completed sections shall be glaze coated when more than one day is required to finish the roofing. Phased construction will not be permitted.

### 3.2 ENVIRONMENTAL CONDITIONS

The temperature of the roofing materials shall be as required by the manufacturer. Air temperature shall be above 40 degrees F and there shall be no visible ice, frost, or moisture on the roof deck when the insulation and roofing are installed. Wind conditions shall be suitable for installation of insulation: Wind chill may affect the proper application temperatures of materials; hot materials may be blown about, creating safety dangers; insulation boards may become difficult and hazardous to handle; wrappers, coverings, and other debris may become airborne, and possibly contaminate laps and seams.

### 3.3 SUBSTRATE PREPARATION

The substrate construction of any bay or section of the building shall be completed before insulation or vapor retarder work is begun thereon. Insulation to be applied directly on concrete shall not be scheduled until joints have been grouted, deck has been primed and allowed to dry, frothing or bubbling does not occur when hot bitumen is applied to the concrete and until the hot bitumen sticks tightly to the concrete. Vents and other items penetrating the roof shall be secured in position and properly prepared for flashing. Prior to application of insulation, substrate joints shall be covered with a 4 inch strip of roofing felt, embedded in and coated with asphalt cement. Substrate surface shall be smooth, clean, and dry at time of application.

### 3.4 HEATING OF ASPHALT

Asphalt shall not be heated higher than 105 degrees F above the EVT or 50 degrees F below the flash point, or 525 degrees F, whichever is lower. EVT and flash point temperatures of asphalt in the kettle shall be conspicuously posted on the kettle. Kettle shall be provided with



automatic thermostatic controls and an accurate thermometer. Kettle operators shall be in attendance at all times during heating to ensure that the maximum temperature is not exceeded. Asphalt shall be applied within a range of 25 degrees F below or above the EVT, or as specified by the manufacturer. Application temperature shall be measured at the mop bucket or mechanical applicator. Asphalt at a temperature below this range shall be returned to the kettle. Flame-heated equipment shall not be placed on the roof.

### 3.5 OMITTED

### 3.6 INSTALLATION OF WOOD NAILERS

Nailers shall be secured to cast-in-place deck materials by not less than 3/8 inch diameter anchors embedded in the deck not over 47 inches on centers. Nailers shall be secured to precast deck materials and to steel decks as indicated. Bolt anchors shall have nuts and washers countersunk, and bolts shall be cut flush with top of nailer. Powder-actuated fasteners, sized and spaced for nailer anchorage equivalent to that specified and indicated, may be used when approved. Surface mounted nailers shall be installed parallel with the roof slope and shall be spaced not over 47 inches face-to-face, except that where the insulation units are less than 47 inches in length the nailers shall be spaced to minimize cutting of the insulation. On sloped roofs exceeding 3/4 inch per foot for modified bituminous systems and 1 inch per foot for BUR systems, nailers shall be installed in accordance with the recommendations of the membrane system manufacturer.

### 3.7 APPLICATION OF INSULATION

Insulation shall be laid in two or more layers. Units of insulation shall be laid in courses parallel with the roof slope. End joints shall be staggered. Insulation shall be cut to fit neatly against adjoining surfaces. Joints between insulation boards shall not exceed 1/4 inch. Insulation under elastomeric membrane shall be tightly butted together. Joints in successive layers shall be staggered with respect to joints of preceding layer. Where insulation is applied over steel deck, long edge joints shall continuously bear on surfaces of the steel deck. Insulation which can be readily lifted after installation is not considered to be adequately secured. Insulation shall be applied so that all roof insulation applied each day is waterproofed the same day. Phased construction will not be permitted. Application of impermeable faced insulation shall be performed without damage to the facing.

#### 3.7.1 Mechanical Fastening

On steel decks, the first layer under modified bitumen and multiple layers of insulation under EPDM membrane shall be mechanically fastened. Method of attachment shall be in accordance with recommendations of the insulation manufacturer and requirements specified.

#### 3.7.2 Steel Decks

All steel decks shall be insulated before receiving a roof membrane.

Uninsulated steel decks shall have insulation applied to span the steel deck flutes and to act as an underlayment for the roof membrane. First layer of insulation on steel deck shall be compatible with mechanical fastening and shall meet fire resistant requirements.

#### 3.7.3 Foam Insulation

Polyisocyanurate, or polystyrene foam insulations shall be isolated from modified bitumen membrane by a separate or composite layer of mineral fiber board, perlite board, glass mat gypsum roof board, or fiberboard. Polystyrene shall not be exposed to solvent-base adhesive, coal-tar bitumen or to asphalt which is hotter than 200 degrees F.

#### 3.7.4 Installation

Except for the first layer on steel deck, insulation layers under modified bitumen shall be laid in solid moppings of hot asphalt applied at a rate of at least 20 pounds per square. Asphalt shall not be applied further than one panel length ahead of roof insulation being installed. Where roof slopes are greater than 1/2 inch/foot, roof insulation shall be held in place by both asphalt mopping and mechanical fasteners. Asphalt primer shall be applied at the rate of 1 gallon per square over the entire surface to be mopped when the insulation is applied over concrete deck. The edges of insulation boards adjoining vented nailers shall be kept free of asphalt.

#### 3.7.5 Protection Requirements

The insulation shall be kept dry at all times. Insulation boards shall not be kicked into position. Exposed edges of the insulation shall be protected by cutoffs at the end of each work day or whenever precipitation is imminent. Cutoffs shall be 2 layers of bituminous-saturated felt set in plastic bituminous cement. Cutoffs shall be removed when work is resumed. Edges of insulation at open spaces between insulation and parapets or other walls and spaces at curbs, scuttles, and expansion joints, shall be protected until permanent roofing and flashing is applied. Storing, walking, wheeling, or trucking directly on insulation or on roofed surfaces will not be permitted. Smooth, clean board or plank walkways, runways, and platforms shall be used, as necessary to distribute weight to conform to a 20 psf live load limit.

#### 3.8 INSPECTION

The Contractor shall establish and maintain an inspection procedure to assure compliance of the installed roof insulation with the contract requirements. Any work found not to be in compliance with the contract shall be promptly removed and replaced or corrected in an approved manner. Quality control shall include, but not be limited to, the following:

- a. Observation of environmental conditions; number and skill level of insulation workers; start and end time of work.
- b. Verification of certification, listing or label compliance with FM P9513.

- c. Verification of proper storage and handling of insulation and vapor retarder materials before, during, and after installation.
- d. Inspection of vapor retarder application, including edge envelopes and mechanical fastening.
- e. Inspection of mechanical fasteners; type, number, length, and spacing.
- f. Coordination with other materials, cants, sleepers, and nailing strips.
- g. Inspection of insulation joint orientation and laps between layers, joint width and bearing of edges of insulation on deck.
- h. Installation of cutoffs and proper joining of work on subsequent days.
- i. Continuation of complete roofing system installation to cover insulation installed same day.

-- End of Section --

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DIVISION 07 - THERMAL & MOISTURE PROTECTION

SECTION 07412

NON-STRUCTURAL METAL ROOFING

10/98

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CEGS-07412 (October 1998)

Includes changes through Notice 3 (April 2000)

SECTION 07412

NON-STRUCTURAL METAL ROOFING  
**10/98**

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

|                   |  |
|-------------------|--|
| ASTM A 463/A 463M | (1999a) Steel Sheet, Aluminum-Coated, by the Hot-Dip Process   |
| ASTM A 653/A 653M | (1999) Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process             |
| ASTM A 792/A 792M | (1999) Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process  |
| ASTM B 209        | (1996) Aluminum and Aluminum-Alloy Sheet and Plate   |
| ASTM C 518        | (1998) Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus |
| ASTM C 1289       | (1998) Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board  |
| ASTM D 226        | (1997a) Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing   |
| ASTM D 522        | (1993a) Mandrel Bend Test of Attached Organic Coatings   |
| ASTM D 610        | (1995) Evaluating Degree of Rusting on Painted Steel Surfaces  |
| ASTM D 714        | (1987; R 1994e1) Evaluating Degree of Blistering of Paints   |

|             |  |
|-------------|--|
| ASTM D 968  | (1993) Abrasion Resistance of Organic Coatings by Falling Abrasive   |
| ASTM D 1308 | (1987; R 1998) Effect of Household Chemicals on Clear and Pigmented Organic Finishes   |
| ASTM D 1654 | (1992) Evaluation of Painted or Coated Specimens Subjected to Corrosive Environments   |
| ASTM D 2244 | (1995) Calculation of Color Differences from Instrumentally Measured Color Coordinates   |
| ASTM D 2247 | (1997) Testing Water Resistance of Coatings in 100% Relative Humidity  |
| ASTM D 2794 | (1993) Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact)   |
| ASTM D 3359 | (1997) Measuring Adhesion by Tape Test   |
| ASTM D 4214 | (1998) Evaluating Degree of Chalking of Exterior Paint Films   |
| ASTM D 4587 | (1991) Conducting Tests on Paint and Related Coatings and Materials Using a Fluorescent UV-Condensation Light- and Water- Exposure Apparatus         |
| ASTM D 5894 | (1996) Standard Practice for Cyclic Salt Fog/UV Exposure of Painted Metal, (Alternating Exposures in a Fog/Dry Cabinet and a UV/Condensation Cabinet |
| ASTM E 84   | (1999) Surface Burning Characteristics of Building Materials   |

UNDERWRITERS LABORATORIES (UL)

|        |  |
|--------|--|
| UL 580 | (1994; Rev thru Feb 1998) Tests for Uplift Resistance of Roof Assemblies |
|--------|--|

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Metal Roofing; G, AE

a. Drawings consisting of catalog cuts, flashing details, erection drawings, shop coating and finishing specifications, and other data as necessary to clearly describe materials, sizes, layouts, construction details, fasteners, and erection. Drawings shall be provided by the metal roofing manufacturer.

b. Drawings showing the UL 580, Class 90 tested roof system assembly.

SD-04 Samples

Accessories

One sample of each type of flashing, trim, fascia, closure, cap and similar items. Size shall be sufficient to show construction and configuration.

Roof Panels

One piece of each type and finish to be used, 9 inches long, full width.

Fasteners

Two samples of each type to be used with statement regarding intended use. If so requested, random samples of screws, bolts, nuts, and washers as delivered to the jobsite shall be taken in the presence of the Contracting Officer and provided to the Contracting Officer for testing to establish compliance with specified requirements.

SD-07 Certificates

Roof Panels  
Installation  
Accessories;

Certificates attesting that the panels and accessories conform to the specified requirements. Certificate for the roof assembly shall certify that the assembly complies with the material and fabrication requirements specified and is suitable for the installation at the indicated design slope. Certified laboratory test reports showing that the sheets to be furnished are produced under a continuing quality control program and that at least 3 representative samples of similar material to that which will be provided on this project have been previously tested and have met the quality standards specified for factory color finish.

Insulation



Certificate attesting that the polyurethane or polyisocyanurate insulation furnished for the project contains recovered material, and showing an estimated percent of such recovered material.

Installer

Certification of installer.

Warranties

At the completion of the project, signed copies of the 5-year Warranty for Non-Structural Metal Roofing System, a sample copy of which is attached to this section, and the 20-year Manufacturer's Material and Weathertightness Warranties.

### 1.3 GENERAL REQUIREMENTS

The Contractor shall furnish a commercially available roofing system which satisfies the specified design and additional requirements contained herein. The roofing system shall be provided by the Contractor as a complete system, as tested and approved in accordance with UL 580. Roof panels, components, transitions, accessories, and assemblies shall be supplied by the same roofing system manufacturer.

#### 1.3.1 Non-Structural Metal Roof System

The Non-Structural Metal Roof System covered under this specification shall include the entire roofing system; the metal roof panels, fasteners, connectors, roof securement components, and assemblies tested and approved in accordance with UL 580. The system shall be installed on a substrate specified in Section 05300 STEEL DECKING. In addition, the system shall consist of panel finishes, insulation, all accessories, components, and trim and all connections with roof panels. This includes roof penetration items such as vents, curbs; exterior gutters and downspouts, eaves, ridge, hip, valley, rake, gable, wall, or other roof system flashings installed and any other components specified within this contract to provide a weathertight roof system; and items specified in other sections of the specifications that are part of the system.

Roof system shall be concealed fastener/clip type, either overlapping standing seam or pan and cover with narrow snap-on cover simulating standing seam.

#### 1.3.2 Manufacturer

The non-structural metal roofing system shall be the product of a manufacturer who has been in the practice of manufacturing metal roofs for a period of not less than 3 years and has been involved in at least five projects similar in size and complexity to this project.

#### 1.3.3 Installer

The installer shall be certified by the metal roof manufacturer to have experience in installing at least three projects that are of comparable

size, scope and complexity as this project for the particular roof system furnished. The installer may be either employed by the manufacturer or be an independent installer.

#### 1.4 DESIGN LOADS

Non-structural Metal Roof System assemblies shall be tested as defined in UL 580 and shall be capable of resisting the wind uplift pressures shown on the contract drawings or, as a minimum, shall be approved to resist wind uplift pressures of UL 580, Class 90.

#### 1.5 PERFORMANCE REQUIREMENTS

The metal roofing system supplied shall conform to the roof slope, the underlayment, and uplift pressures shown on the contract drawings. The Contractor shall furnish a commercially available roofing system which satisfies all the specified requirements.

#### 1.6 DELIVERY AND STORAGE

Materials shall be delivered to the site in a dry and undamaged condition and stored out of contact with the ground. Materials shall be covered with weather tight coverings and kept dry. Material shall not be covered with plastic where such covering will allow sweating and condensation. Plastic may be used as tenting with air circulation allowed. Storage conditions shall provide good air circulation and protection from surface staining.

#### 1.7 WARRANTIES

The Non-Structural Metal Roofing System shall be warranted as outlined below. Any emergency temporary repairs conducted by the owner shall not negate the warranties.

##### 1.7.1 Contractor's Weathertightness Warranty

The Non-Structural Metal Roofing System shall be warranted by the Contractor on a no penal sum basis for a period of five years against material and workmanship deficiencies; system deterioration caused by exposure to the elements and/or inadequate resistance to specified service design loads, water leaks, and wind uplift damage. The roofing covered under this warranty shall include the entire roofing system, including but not limited to, the roof panels, fasteners, connectors, roof securement components, and assemblies tested and approved in accordance with UL 580. In addition, the system shall consist of panel finishes, slip sheet, insulation, vapor retarder, all accessories, components, and trim and all connections with roof panels. This includes roof penetration items such as vents, curbs, skylights; interior or exterior gutters and downspouts; eaves, ridge, hip, valley, rake, gable, wall, or other roof system flashings installed and any other components specified within this contract to provide a weathertight roof system; and items specified in other sections of the specifications that are part of the roof system. All material and workmanship deficiencies, system deterioration caused by exposure to the elements and/or inadequate resistance to service design loads, water leaks and wind uplift damage shall be repaired as approved by

the Contracting Officer. See the attached Contractor's required warranty for issue resolution of warrantable defects. This warranty shall warrant and cover the entire cost of repair or replacement, including all material, labor, and related markups. The Contractor shall supplement this warranty with written warranties from the installer and system manufacturer, which shall be submitted along with Contractor's warranty; however, the Contractor shall be ultimately responsible for this warranty. The Contractor's written warranty shall be as outlined in attached WARRANTY FOR NON-STRUCTURAL METAL ROOF SYSTEM, and shall start upon final acceptance of the facility. It is required that the Contractor provide a separate bond in an amount equal to the installed total roofing system cost in favor of the owner (Government) covering the Contractor's warranty responsibilities effective throughout the 5 year Contractor's warranty period for the entire roofing system as outlined above.

#### 1.7.2 Manufacturer's Material Warranties

The Contractor shall furnish, in writing, the following manufacturer's material warranties which cover all Non-Structural Metal Roofing System components such as roof panels, flashing, accessories, and trim, fabricated from coil material:

a. A manufacturer's 20 year material warranty warranting that the aluminum, zinc-coated steel, aluminum-zinc alloy coated steel or aluminum-coated steel as specified herein will not rupture, fail structurally, or perforate under normal atmospheric conditions at the site.

Liability under this warranty shall be limited exclusively to the cost of either repairing or replacing nonconforming, ruptured, perforated, or structurally failed coil material.

b. A manufacturer's 20 year exterior material finish warranty warranting that the factory color finish, under normal atmospheric conditions at the site, will not crack, peel, or delaminate; chalk in excess of a numerical rating of 8 when measured in accordance with ASTM D 4214; or fade or change colors in excess of 5 NBS units as measured in accordance with ASTM D 2244. Liability under this warranty is exclusively limited to refinishing or replacing the defective coated coil material.

c. A roofing system manufacturer's 20 year system weathertightness warranty.

#### 1.8 COORDINATION MEETING

A coordination meeting shall be held within 45 days after contract award for mutual understanding of the metal roofing system contract requirements.

This meeting shall take place at the building site and shall include representatives from the Contractor, the roofing system manufacturer, the roofing supplier, the erector, the designer, and the Contracting Officer. All items required by paragraph SUBMITTALS shall be discussed, including applicable standard manufacturer shop drawings, and the approval process. The Contractor shall coordinate time and arrangements for the meeting.

#### PART 2 PRODUCTS

## 2.1 ROOF PANELS

Panels shall be steel or aluminum and shall have a factory color finish. Length of sheets shall be sufficient to cover the entire length of any unbroken roof slope for slope lengths that do not exceed 30 feet. Sheets longer than 30 feet may be furnished if approved by the Contracting Officer. Width of sheets shall provide nominal 12 inches of coverage in place. Design provisions shall be made for thermal expansion and contraction consistent with the type of system to be used. All sheets shall be either square-cut or miter-cut. The ridge cap shall be installed as recommended by the metal roofing manufacturer. Height of corrugations, ribs, or seams, at overlap of adjacent roof sheets shall be the building manufacturer's standard for the indicated roof slope.

### 2.1.1 Steel Panels

Zinc-coated steel conforming to ASTM A 653/A 653M; aluminum-zinc alloy coated steel conforming to ASTM A 792/A 792M, AZ 50 coating; or aluminum-coated steel conforming to ASTM A 463/A 463M, Type 2, coating designation T2 65. Uncoated roof panels shall be 0.024 inch thick minimum. Panels shall be within 95 percent of the nominal thickness.

### 2.1.2 Aluminum Panels

Alloy conforming to ASTM B 209, temper as required for the forming operation, minimum 0.032 inch thick.

## 2.2 ACCESSORIES

Accessories shall be compatible with the roofing furnished. Flashing, trim, metal closure strips, caps, and similar metal accessories shall be not less than the minimum thicknesses specified for roof panels. Exposed metal accessories shall be finished to match the panels furnished. Molded closure strips shall be bituminous-saturated fiber, closed-cell or solid-cell synthetic rubber or neoprene, or polyvinyl chloride premolded to match configuration of the panels and shall not absorb or retain water.

## 2.3 FASTENERS

Concealed fasteners and clips for roof panels shall be zinc-coated steel, aluminum, or nylon capped steel, type and size as recommended by the manufacturer to meet the performance requirements. Fasteners for accessories shall be the manufacturer's standard. Exposed roof fasteners shall be gasketed or have gasketed washers on the exterior side of the roofing to waterproof the fastener penetration. Washer material shall be compatible with the panels; and gasketed portion of fasteners or washers shall be neoprene or other equally durable elastomeric material approximately 1/8 inch thick.

## 2.4 FACTORY COLOR FINISH

Panels shall have a factory applied polyvinylidene fluoride finish on the exposed side. The exterior finish shall consist of a baked-on topcoat with an appropriate prime coat. Color shall match the color indicated on the

drawings. The exterior coating shall be a nominal 1 mil thickness consisting of a topcoat of not less than 0.7 mil dry film thickness and the paint manufacturer's recommended primer of not less than 0.2 mil thickness. The exterior color finish shall meet the test requirements specified below.

#### 2.4.1 Cyclic Salt Fog/UV Test

A sample of the sheets shall withstand a cyclic corrosion test for a minimum of 2016 hours in accordance with ASTM D 5894, including the scribe requirement in the test. Immediately upon removal of the panel from the test, the coating shall receive a rating of not less than 10, no blistering, as determined by ASTM D 714; 10, no rusting, as determined by ASTM D 610; and a rating of 6, over 1/16 to 1/8 inch failure at scribe, as determined by ASTM D 1654.

#### 2.4.2 Formability Test

When subjected to testing in accordance with ASTM D 522 Method B, 1/8 inch diameter mandrel, the coating film shall show no evidence of fracturing to the naked eye.

#### 2.4.3 Accelerated Weathering, Chalking Resistance and Color Change

A sample of the sheets shall be tested in accordance with ASTM D 4587, test condition B for 2000 total hours. The coating shall withstand the weathering test without cracking, peeling, blistering, loss of adhesion of the protective coating, or corrosion of the base metal. Protective coating that can be readily removed from the base metal with tape in accordance with ASTM D 3359, Test Method B, shall be considered as an area indicating loss of adhesion. Following the accelerated weathering test, the coating shall have a chalk rating not less than No. 8 in accordance with ASTM D 4214 test procedures, and the color change shall not exceed 5 CIE or Hunter Lab color difference (delta E) units in accordance with ASTM D 2244. For sheets required to have a low gloss finish, the chalk rating shall be not less than No. 6 and the color difference shall be not greater than 7 units.

#### 2.4.4 Humidity Test

When subjected to a humidity cabinet test in accordance with ASTM D 2247 for 1000 hours, a scored panel shall show no signs of blistering, cracking, creepage or corrosion.

#### 2.4.5 Impact Resistance

Factory-painted sheet shall withstand direct and reverse impact in accordance with ASTM D 2794 0.500 inch diameter hemispherical head indenter, equal to 1.5 times the metal thickness in mils, expressed in inch-pounds, with no cracking.

#### 2.4.6 Abrasion Resistance Test

When subjected to the falling sand test in accordance with ASTM D 968,

Method A, the coating system shall withstand a minimum of 50 liters of sand before the appearance of the base metal. The term "appearance of base metal" refers to the metallic coating on steel or the aluminum base metal.

2.4.7 Omitted

2.4.8 Pollution Resistance

Coating shall show no visual effects when covered spot tested in a 10 percent hydrochloric acid solution for 24 hours in accordance with ASTM D 1308.

2.5 UNDERLAYMENTS

2.5.1 Felt Underlayment

Felt underlayment shall be No. 30 felt in accordance with ASTM D 226, Type II.

2.5.2 Rubberized Underlayment

Rubberized underlayment shall be equal to "Ice and Water Shield" as manufactured by Grace Construction Products, "Winterguard" as manufactured by CertainTeed Corporation, or "Weather Watch Ice and Water Barrier" as manufactured by GAF Building Materials Corporation.

2.6 INSULATION

Thermal resistance of insulation shall be not less than the R-values shown on the contract drawings. R-values shall be determined at a mean temperature of 75 degrees F in accordance with ASTM C 518. Insulation shall be a standard product with the insulation manufacturer, factory marked or identified with insulation manufacturer's name or trademark and R-value. Identification shall be on individual pieces or individual packages. Insulation shall have a flame spread not in excess of 25 and a smoke developed rating not in excess of 250 when tested in accordance with ASTM E 84. The stated R-value of the insulation shall be certified by an independent Registered Professional Engineer if tests are conducted in the insulation manufacturer's laboratory.

2.6.1 Rigid Board Insulation for Use Above a Roof Deck

2.6.1.1 Polyisocyanurate

Polyisocyanurate insulation shall conform to ASTM C 1289, Type I, Class 2 (having a minimum recovered material content of 9 percent by weight of core material in the polyisocyanurate portion). For impermeable faced polyisocyanurate (Ex: aluminum foil) the maximum design R-value per 1 inch of insulation used shall be 7.2.

2.6.1.2 Omitted

2.7 OMITTED

## 2.8 SEALANT

Sealant shall be an elastomeric type containing no oil or asphalt. Exposed sealant shall be colored to match the applicable building color and shall cure to a rubberlike consistency. Sealant placed in the roof panel standing seam ribs shall be provided in accordance with the manufacturer's recommendations.

## 2.9 GASKETS AND INSULATING COMPOUNDS

Gaskets and insulating compounds shall be nonabsorptive and suitable for insulating contact points of incompatible materials. Insulating compounds shall be nonrunning after drying.

# PART 3 EXECUTION

## 3.1 INSTALLATION

Installation shall be in accordance with the manufacturer's erection instructions and drawings. Dissimilar materials which are not compatible when contacting each other shall be insulated by means of gaskets or insulating compounds. Sheets with improper or mislocated drill holes shall not be used. Exposed surfaces and edges shall be kept clean and free from sealant, metal cuttings, hazardous burrs, and other foreign material. Stained, discolored, or damaged sheets shall be removed from the site.

### 3.1.1 Roofing

Side laps shall be laid away from the prevailing winds. Side and end lap distances, joint sealing, and fastening and spacing of fasteners shall be in accordance with manufacturer's standard practice. Side laps and end laps of roof panels and joints at accessories shall be sealed. Fasteners shall be driven normal to the surface. Method of applying joint sealant shall conform to the manufacturer's recommendation to achieve a complete weathertight installation. Accessories shall be fastened into steel substrate, except as otherwise approved. Closure strips shall be provided as indicated and where necessary to provide weathertight construction.

### 3.1.2 Omitted

### 3.1.3 Underlayment

Underlayment types shall be installed where shown on the drawings; they shall be installed directly over the substrate. If a roof panel rests directly on the underlayments, a slip sheet shall be installed as a top layer, beneath the metal roofing panels, to prevent adhesion. All underlayments shall be installed so that successive strips overlap the next lower strip in shingle fashion. Underlayments shall be installed in accordance with the manufacturer's written instructions. The underlayments shall ensure that any water that penetrates below the metal roofing panels will drain outside of the building envelope.

## 3.2 INSULATION INSTALLATION

Insulation shall be installed as indicated and in accordance with manufacturer's instructions. Insulation shall be continuous over entire roof surface. Where expansion joints, terminations, and other connections are made, the cavity shall be filled with batt insulation and vapor retarder providing equivalent R-Value and perm rating as remaining insulation.

#### 3.2.1 Board Insulation in Warm Climates

Rigid or semirigid board insulation shall be laid in close contact. Rigid insulation shall be attached to the metal roof deck with bearing plates and fasteners, as recommended by the insulation manufacturer, so that the insulation joints are held tight against each other, with no less than 1 fastener and bearing plates per 4 square feet of insulation. Layout and joint pattern of insulation and fasteners shall be indicated on the shop drawings.



CONTRACTOR'S FIVE (5) YEAR NO PENAL SUM WARRANTY  
FOR  
NON-STRUCTURAL METAL ROOF SYSTEM

FACILITY DESCRIPTION\_\_\_\_\_

BUILDING NUMBER:\_\_\_\_\_

CORPS OF ENGINEERS CONTRACT NUMBER:\_\_\_\_\_

CONTRACTOR

CONTRACTOR:\_\_\_\_\_

ADDRESS:\_\_\_\_\_

POINT OF CONTACT:\_\_\_\_\_

TELEPHONE NUMBER:\_\_\_\_\_

OWNER

OWNER:\_\_\_\_\_

ADDRESS:\_\_\_\_\_

POINT OF CONTACT:\_\_\_\_\_

TELEPHONE NUMBER:\_\_\_\_\_

CONSTRUCTION AGENT

CONSTRUCTION AGENT:\_\_\_\_\_

ADDRESS:\_\_\_\_\_

POINT OF CONTACT:\_\_\_\_\_

TELEPHONE NUMBER:\_\_\_\_\_

CONTRACTOR'S FIVE (5) YEAR NO PENAL SUM WARRANTY  
FOR  
NON-STRUCTURAL METAL ROOF SYSTEM  
(continued)

THE NON-STRUCTURAL METAL ROOF SYSTEM INSTALLED ON THE ABOVE NAMED BUILDING IS WARRANTED BY \_\_\_\_\_ FOR A PERIOD OF FIVE (5) YEARS AGAINST WORKMANSHIP AND MATERIAL DEFICIENCIES, WIND DAMAGE, STRUCTURAL FAILURE, AND LEAKAGE. THE NON-STRUCTURAL METAL ROOFING SYSTEM COVERED UNDER THIS WARRANTY SHALL INCLUDE, BUT SHALL NOT BE LIMITED TO, THE FOLLOWING: THE ENTIRE ROOFING SYSTEM, MANUFACTURER SUPPLIED FRAMING AND STRUCTURAL MEMBERS, METAL ROOF PANELS, FASTENERS, CONNECTORS, ROOF SECUREMENT COMPONENTS, AND ASSEMBLIES TESTED AND APPROVED IN ACCORDANCE WITH UL 580. IN ADDITION, THE SYSTEM PANEL FINISHES, SLIP SHEET, INSULATION, VAPOR RETARDER, ALL ACCESSORIES, COMPONENTS, AND TRIM AND ALL CONNECTIONS ARE INCLUDED. THIS INCLUDES ROOF PENETRATION ITEMS SUCH AS VENTS, CURBS, SKYLIGHTS; INTERIOR OR EXTERIOR GUTTERS AND DOWNSPOUTS; EAVES, RIDGE, HIP, VALLEY, RAKE, GABLE, WALL, OR OTHER ROOF SYSTEM FLASHINGS INSTALLED AND ANY OTHER COMPONENTS SPECIFIED WITHIN THIS CONTRACT TO PROVIDE A WEATHERTIGHT ROOF SYSTEM; AND ITEMS SPECIFIED IN OTHER SECTIONS OF THE SPECIFICATIONS THAT ARE PART OF THE NON-STRUCTURAL METAL ROOFING SYSTEM.

ALL MATERIAL DEFICIENCIES, WIND DAMAGE, STRUCTURAL FAILURE, AND LEAKAGE ASSOCIATED WITH THE NON-STRUCTURAL METAL ROOF SYSTEM COVERED UNDER THIS WARRANTY SHALL BE REPAIRED AS APPROVED BY THE CONTRACTING OFFICER. THIS WARRANTY SHALL COVER THE ENTIRE COST OF REPAIR OR REPLACEMENT, INCLUDING ALL MATERIAL, LABOR, AND RELATED MARKUPS. THE ABOVE REFERENCED WARRANTY COMMENCED ON THE DATE OF FINAL ACCEPTANCE ON \_\_\_\_\_ AND WILL REMAIN IN EFFECT FOR STATED DURATION FROM THIS DATE.

SIGNED, DATED, AND NOTARIZED (BY COMPANY PRESIDENT)

\_\_\_\_\_  
(Company President)

\_\_\_\_\_  
(Date)

CONTRACTOR'S FIVE (5) YEAR NO PENAL SUM WARRANTY  
FOR  
NON-STRUCTURAL METAL ROOFING SYSTEM  
(continued)

THE CONTRACTOR SHALL SUPPLEMENT THIS WARRANTY WITH WRITTEN WARRANTIES FROM THE MANUFACTURER AND/OR INSTALLER OF THE NON-STRUCTURAL METAL ROOFING SYSTEM, WHICH SHALL BE SUBMITTED ALONG WITH THE CONTRACTOR'S WARRANTY. HOWEVER, THE CONTRACTOR WILL BE ULTIMATELY RESPONSIBLE FOR THIS WARRANTY AS OUTLINED IN THE SPECIFICATIONS AND AS INDICATED IN THIS WARRANTY EXAMPLE.

EXCLUSIONS FROM COVERAGE

1. NATURAL DISASTERS, ACTS OF GOD (LIGHTNING, FIRE, EXPLOSIONS, SUSTAINED WIND FORCES IN EXCESS OF THE DESIGN CRITERIA, EARTHQUAKES, AND HAIL).
2. ACTS OF NEGLIGENCE OR ABUSE OR MISUSE BY GOVERNMENT OR OTHER PERSONNEL, INCLUDING ACCIDENTS, VANDALISM, CIVIL DISOBEDIENCE, WAR, OR DAMAGE CAUSED BY FALLING OBJECTS.
3. DAMAGE BY STRUCTURAL FAILURE, SETTLEMENT, MOVEMENT, DISTORTION, WARPAGE, OR DISPLACEMENT OF THE BUILDING STRUCTURE OR ALTERATIONS MADE TO THE BUILDING.
4. CORROSION CAUSED BY EXPOSURE TO CORROSIVE CHEMICALS, ASH OR FUMES GENERATED OR RELEASED INSIDE OR OUTSIDE THE BUILDING FROM CHEMICAL PLANTS, FOUNDRIES, PLATING WORKS, KILNS, FERTILIZER FACTORIES, PAPER PLANTS, AND THE LIKE.
5. FAILURE OF ANY PART OF THE NON-STRUCTURAL METAL ROOF DUE TO ACTIONS BY THE OWNER TO INHIBIT FREE DRAINAGE OF WATER FROM THE ROOF AND GUTTERS AND DOWNSPOUTS OR ALLOW PONDING WATER TO COLLECT ON THE ROOF SURFACE. CONTRACTOR'S DESIGN SHALL INSURE FREE DRAINAGE FROM THE ROOF AND NOT ALLOW PONDING WATER.
6. THIS WARRANTY APPLIES TO THE NON-STRUCTURAL METAL ROOFING SYSTEM. IT DOES NOT INCLUDE ANY CONSEQUENTIAL DAMAGE TO THE BUILDING INTERIOR OR CONTENTS WHICH IS COVERED BY THE WARRANTY OF CONSTRUCTION CLAUSE INCLUDED IN THIS CONTRACT.
7. THIS WARRANTY CANNOT BE TRANSFERRED TO ANOTHER OWNER WITHOUT WRITTEN CONSENT OF THE CONTRACTOR; AND THIS WARRANTY AND THE CONTRACT PROVISIONS WILL TAKE PRECEDENCE OVER ANY CONFLICTS WITH STATE STATUTES.

\*\*

CONTRACTOR'S FIVE (5) YEAR NO PENAL SUM WARRANTY  
FOR  
NON-STRUCTURAL METAL ROOF SYSTEM  
(continued)

\*\*REPORTS OF LEAKS AND ROOF SYSTEM DEFICIENCIES SHALL BE RESPONDED TO WITHIN 48 HOURS OF RECEIPT OF NOTICE, BY TELEPHONE OR IN WRITING, FROM EITHER THE OWNER OR CONTRACTING OFFICER. EMERGENCY REPAIRS TO PREVENT FURTHER ROOF LEAKS SHALL BE INITIATED IMMEDIATELY; A WRITTEN PLAN SHALL BE SUBMITTED FOR APPROVAL TO REPAIR OR REPLACE THIS ROOF SYSTEM WITHIN SEVEN (7) CALENDAR DAYS. ACTUAL WORK FOR PERMANENT REPAIRS OR REPLACEMENT SHALL BE STARTED WITHIN 30 DAYS AFTER RECEIPT OF NOTICE, AND COMPLETED WITHIN A REASONABLE TIME FRAME. IF THE CONTRACTOR FAILS TO ADEQUATELY RESPOND TO THE WARRANTY PROVISIONS, AS STATED IN THE CONTRACT AND AS CONTAINED HEREIN, THE CONTRACTING OFFICER MAY HAVE THE NON-STRUCTURAL METAL ROOF SYSTEM REPAIRED OR REPLACED BY OTHERS AND CHARGE THE COST TO THE CONTRACTOR.

IN THE EVENT THE CONTRACTOR DISPUTES THE EXISTENCE OF A WARRANTABLE DEFECT, THE CONTRACTOR MAY CHALLENGE THE OWNER'S DEMAND FOR REPAIRS AND/OR REPLACEMENT DIRECTED BY THE OWNER OR CONTRACTING OFFICER EITHER BY REQUESTING A CONTRACTING OFFICER'S DECISION UNDER THE CONTRACT DISPUTES ACT, OR BY REQUESTING THAT AN ARBITRATOR RESOLVE THE ISSUE. THE REQUEST FOR AN ARBITRATOR MUST BE MADE WITHIN 48 HOURS OF BEING NOTIFIED OF THE DISPUTED DEFECTS. UPON BEING INVOKED, THE PARTIES SHALL, WITHIN TEN (10) DAYS, JOINTLY REQUEST A LIST OF FIVE (5) ARBITRATORS FROM THE FEDERAL MEDIATION AND CONCILIATION SERVICE. THE PARTIES SHALL CONFER WITHIN TEN (10) DAYS AFTER RECEIPT OF THE LIST TO SEEK AGREEMENT ON AN ARBITRATOR. IF THE PARTIES CANNOT AGREE ON AN ARBITRATOR, THE CONTRACTING OFFICER AND THE PRESIDENT OF THE CONTRACTOR'S COMPANY WILL STRIKE ONE (1) NAME FROM THE LIST ALTERNATIVELY UNTIL ONE (1) NAME REMAINS. THE REMAINING PERSON SHALL BE THE DULY SELECTED ARBITRATOR. THE COSTS OF THE ARBITRATION, INCLUDING THE ARBITRATOR'S FEE AND EXPENSES, COURT REPORTER, COURTROOM OR SITE SELECTED, ETC., SHALL BE BORNE EQUALLY BETWEEN THE PARTIES. EITHER PARTY DESIRING A COPY OF THE TRANSCRIPT SHALL PAY FOR THE TRANSCRIPT. A HEARING WILL BE HELD AS SOON AS THE PARTIES CAN MUTUALLY AGREE. A WRITTEN ARBITRATOR'S DECISION WILL BE REQUESTED NOT LATER THAN 30 DAYS FOLLOWING THE HEARING. THE DECISION OF THE ARBITRATOR WILL NOT BE BINDING; HOWEVER, IT WILL BE ADMISSIBLE IN ANY SUBSEQUENT APPEAL UNDER THE CONTRACT DISPUTES ACT.

A FRAMED COPY OF THIS WARRANTY SHALL BE POSTED IN THE MECHANICAL ROOM OR OTHER APPROVED LOCATION DURING THE ENTIRE WARRANTY PERIOD.

-- End of Section --

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DIVISION 07 - THERMAL & MOISTURE PROTECTION

SECTION 07551

MODIFIED BITUMEN ROOFING

01/98

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UFGS-07551 (January 1998)

SECTION 07551

MODIFIED BITUMEN ROOFING  
**01/98**

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

|             |  |
|-------------|--|
| ASTM C 208  | (1995) Cellulosic Fiber Insulating Board                               |
| ASTM D 41   | (1994) Asphalt Primer Used in Roofing, Dampproofing, and Waterproofing |
| ASTM D 312  | (1995a) Asphalt Used in Roofing  |
| ASTM D 3746 | (1985; R 1996) Impact Resistance of Bituminous Roofing Systems         |
| ASTM D 4586 | (1993) Asphalt Roof Cement, Asbestos Free                              |
| ASTM D 4601 | (1997) Asphalt-Coated Glass Fiber Base Sheet Used in Roofing           |
| ASTM D 5147 | (1997) Sampling and Testing Modified Bituminous Sheet Material         |

FACTORY MUTUAL ENGINEERING AND RESEARCH (FM)

|           |  |
|-----------|--|
| FM P7825c | (1998) Approval Guide Building Materials |
|-----------|--|

UNDERWRITERS LABORATORIES (UL)

|                |   |
|----------------|---|
| UL Bld Mat Dir | (1998) Building Materials Directory                         |
| UL 790         | (1997) Tests for Fire Resistance of Roof Covering Materials |

1.2 SYSTEM DESCRIPTION

The modified bitumen roofing system shall consist of a manufacturer's standard, prefabricated, reinforced polymer-modified bitumen membrane, with

base sheet, and insulation as specified and indicated. The manufacturer shall have a minimum of 5 years experience in manufacturing of the proposed modified bitumen sheet roofing for similar applications.

### 1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

#### SD-03 Product Data

##### EVT and Flash Point

Bills of lading shall indicate the flash point and equiviscous temperature (EVT) and this information shall be shown on labels for each unit (or plug) of asphalt.

##### Materials Installation

Manufacturer's instructions, including membrane description and performance data, detailed procedure for installation, and safety precautions, prior to the start of roofing work.

#### SD-07 Certificates

##### Manufacturer

Evidence that the manufacturer has a minimum of 5 years experience manufacturing modified bitumen roofing. The roofing system applicator shall be approved by the modified bitumen roofing manufacturer, and shall have a minimum of 3 years experience as an approved applicator. A list of installations using the same products and applicator as proposed shall be included.

##### Materials

Certificates of compliance for felts, bitumens, and membrane sheet.

### 1.4 STORAGE OF MATERIALS

Felts and roofing sheets shall be kept dry before, during, and after delivery to the site. Felts and roofing sheets shall be stored on end one level high, in an enclosed building or trailer and on platforms, off the deck or floor. Felts and sheets shall be maintained at a temperature above 50 degrees F for 24 hours immediately before laying.

### 1.5 COORDINATION REQUIREMENTS



The work shall be coordinated with other trades to ensure that components are available when they are to be secured or stripped into the roofing system.

#### 1.5.1 Insulation Application

Application of roofing shall immediately follow application of insulation as a continuous operation.

#### 1.5.2 Flashing

Modified bituminous sheet shall be used for flashings where the roof deck abuts angles, vertical surfaces, edge metal, and penetrations, unless otherwise specified or indicated. Flashing shall be installed as the work progresses.

#### 1.5.3 Sheet Metalwork

Sheet metalwork specified in Section 07600 SHEET METALWORK, GENERAL shall be coordinated with roofing operations.

#### 1.6 ENVIRONMENTAL CONDITIONS

Air temperature shall be above 40 degrees F and there shall be no visible ice, frost, or moisture on the roof deck at the time roofing is installed.

#### 1.7 FLAME HEATED EQUIPMENT

Flame heated kettles shall not be placed on the roof. Torch application shall be approved by the membrane manufacturer for the specific modified bitumen. Open flame equipment shall not be left unattended while ignited.

#### 1.8 ELECTRIC-HEATED EQUIPMENT

Adequate electrical service shall be provided as required by the manufacturer of the equipment, to insure proper application of the roofing materials.

#### 1.9 FIRE AND WIND UPLIFT REQUIREMENTS

The complete roof system shall have aUL 790, Class A or B classification, be listed as "fire classified" in UL Bld Mat Dir, and bear the UL label or be listed as a Class I Roof Deck in FM P7825c. Roofing system over steel deck shall be rated Class I- 90 in accordance with FM P7825c. Ratings from other independent laboratories may be substituted provided that the tests, requirements and ratings are documented to be equivalent, to the satisfaction of the Contracting Officer.

#### 1.10 WARRANTY

Manufacturer's standard warranty for the roofing system shall be provided for not less than 10 years from acceptance of the work. Warranty shall state that manufacturer shall repair or replace defective materials if the roofing system leaks or allows the insulation beneath the membrane to

become wet during the period of the warranty.

## PART 2 PRODUCTS

### 2.1 PRIMER

Primer shall conform to ASTM D 41.

### 2.2 ASPHALT

Asphalt shall conform to ASTM D 312, Type III for slopes up to 25 percent (1/4 vertical/horizontal) and Type IV for slopes up to 50 percent (1/2 vertical/horizontal).

### 2.3 BITUMINOUS CEMENT

Bituminous cement shall conform to ASTM D 4586.

### 2.4 CANTS AND WOOD NAILERS

Treated wood cants and wood nailers shall be of water-borne preservative-treated material as specified in Section 06100 ROUGH CARPENTRY. Cants shall be made from treated wood or treated fiberboard not less than 3-1/2 inches high and cut to reduce change in direction of the membrane to 45 degrees or less. Fiberboard shall conform to ASTM C 208, treated with sizing, wax or bituminous impregnation. When membrane or flashing is to be torch applied, cants shall be fire resistant.

### 2.5 BASE SHEET

Non venting base sheet shall conform to ASTM D 4601, Type II.

### 2.6 MODIFIED BITUMEN SHEET

Modified bitumen sheet shall be a bitumen modified by styrene butadiene styrene (SBS); or modified by SBS which has been further modified with styrene ethylene butadiene styrene (SEBS). Sheets shall be uniform in thickness and appearance, and free from blisters or tape splices. Sheets shall not stick to the roll or stack, and shall be suitable for joining along the entire length by the procedure recommended by the manufacturer. Sheet shall be reinforced with fiber made from glass, polypropylene, or polyester, and shall meet the following requirements:

#### MODIFIED BITUMEN SHEET PROPERTIES

Maximum Load/Elongation, ASTM D 5147 weakest (longitudinal or transverse) direction:

|  |            |
|--|------------|
| Maximum load, minimum                      | 90 lbf/in. |
| Elongation, minimum, when reinforced with: |            |
| glass fiber                                | 3 percent  |
| polyester or polypropylene                 | 40 percent |

Tear Strength, ASTM D 5147

|         |           |
|---------|-----------|
| Minimum | 80 pounds |
|---------|-----------|

MODIFIED BITUMEN SHEET PROPERTIES

Low Temperature Flexibility, ASTM D 5147      SBS: minus 15 degrees F

Impact Resistance, ASTM D 3746      No Damage

2.7    NAILS AND FASTENERS

Nails and fasteners shall be an approved type recommended by the roofing felt or membrane manufacturer.

2.8    SURFACING MATERIAL

Surfacing shall be factory applied granules requiring no further coating.

2.9    ADHESIVE

Adhesive shall be an approved type recommended by the membrane manufacturer.

2.10   OMITTED

2.11   INSULATION

Insulation shall be compatible with the membrane, as recommended by the membrane manufacturer's printed instructions, and as specified in Section 07220 ROOF INSULATION.

PART 3    EXECUTION

3.1    PREPARATION REQUIREMENTS

The substrate construction of any bay or section of the building shall be completed before roofing work is begun thereon. Vents and other items penetrating the roof shall be secured in position and properly prepared for flashing. Nailers, curbs and other items attached to roof surface shall be in place before roofing is begun.

3.2    INSTALLATION OF CANTS

Cants shall be installed in the angles formed between the roof and walls or other vertical surfaces. Cants shall be laid in a solid coat of bituminous cement just prior to laying the base sheet or membrane. Cants shall be continuous, and shall be installed in lengths as long as practicable.

3.3    CONDITION OF SURFACES

Surfaces shall be inspected and approved immediately prior to application of roofing and flashings. The roofing and flashings shall be applied to a smooth and firm surface free from ice, frost, visible moisture, dirt, projections, and foreign materials. Prior to application of primer on precast concrete decks, joints shall be covered with a 4 inch strip of roofing felt, embedded in and coated with bituminous cement. Modified bitumen membrane shall be isolated from coal tar pitch.

### 3.4 MECHANICAL APPLICATION DEVICES

Mechanical application devices shall be mounted on pneumatic-tired wheels, and shall be designed and maintained to operate without damaging the insulation, roofing membrane, or structural components.

### 3.5 PRIMING

Concrete, masonry and metal surfaces to receive bitumen shall be uniformly coated with primer at a rate of not less than 1 gallon per square and allowed to dry.

### 3.6 HEATING OF BITUMEN

Asphalt shall not be heated higher than 75 degrees F above the EVT or 50 degrees F below the flash point or 525 degrees F (maximum) whichever is lower. EVT and flash point temperatures of asphalt in the kettle shall be conspicuously posted on the kettle. Heating kettle shall be provided with automatic thermostatic control and an accurate thermometer. Kettle operators shall be in attendance at all times during the heating to ensure that the maximum temperature specified is not exceeded. An asphalt tanker shall be treated as a kettle.

### 3.7 BITUMEN APPLICATION

Asphalt shall be applied within 25 degrees F below or above the EVT, or 400 degrees F, whichever is higher. Application temperatures shall be measured at the mop bucket or mechanical applicator. Bitumen at a temperature below the recommended temperature shall be returned to the kettle.

### 3.8 APPLICATIONS OF BASE SHEET

Base sheet shall be applied, shingle fashion, in a continuous operation, with side laps in accordance with manufacturer's printed instructions. End laps shall be not less than 6 inches and staggered a minimum of 24 inches.

Base sheets shall be applied at right angles to the slope (except on curved or steep deck) and laps shall face down the slope. Non venting base sheet shall be applied in hot mopping of not less than 20 pounds nor more than 35 pounds of asphalt per square and shall be embedded in the hot asphalt with a squeegee or broom to eliminate air pockets and assure complete adhesion. Operator shall avoid heavy application of squeegees to glass-fiber sheets.

### 3.9 MODIFIED BITUMEN MEMBRANE APPLICATION

Membrane shall be two plies. Each sheet in each ply shall be fully adhered to the underlying surface. Sheet edges shall lie flat, with no fishmouths or wrinkles. Installation shall begin at the low point of the roof and progress to the high point with each sheet installed shingle fashion. Each sheet shall be unrolled to provide 4 inch side laps and 6 inch end laps. End laps shall be staggered not less than 24 inches. Laps shall not coincide with laps of base layers except at lines of permanent termination.

Sheets shall be embedded in hot solid-mopped asphalt, applied at a rate of 20 to 30 pounds per square. Hot asphalt shall flow out of all side and end laps. End laps shall be back-mopped.

3.10 TERMINATIONS AT PERIMETERS

The modified bitumen membrane shall extend up abutting surface at least 4 inches or 2 inches above the top of the cant.

3.11 OMITTED

3.12 PROTECTION OF APPLIED ROOFING

At end of day's work or whenever precipitation is imminent, the terminated edge of the roofing shall be sealed with two full width strips of roofing felt set in and coated with bituminous cement or hot mopped asphalt. One half-width of strips shall be extended up and over the finished roofing and the other half-width extended out and onto the bare roof deck or existing membrane. Sealing strips shall be removed before continuing installation of roofing. To facilitate sealing, termination edges may be straightened with pieces of insulation board which shall be removed when work is resumed.

3.13 FLASHINGS

Flashings shall be provided over cants, in the angles formed at walls and other vertical surfaces, and where required to make the work watertight. Modified bitumen flashings shall be used, except where metal flashings are specified in other sections of the specifications.

3.14 OMITTED

3.15 OMITTED

3.16 OMITTED

3.17 OMITTED

3.18 OMITTED

3.19 INSPECTION

The Contractor shall establish and maintain an inspection procedure to assure compliance of the installed roofing with the contract requirements. Any work found not to be in compliance with the contract shall be promptly removed and replaced or corrected in an approved manner. Inspection shall include, but not be limited to, the following:

- a. Observation of environmental conditions; number and skill level of roofing workers; start and end time of various tasks; condition of substrate.
- b. Verification of compliance of materials before, during, and after installation.
- c. Inspection of condition of equipment and accuracy of thermometers and metering devices.
- d. Inspection of flashings, cants and curbs.

- e. Inspection of membrane placement, including edge envelopes, widths of starter sheets, laps, proper use of squeegee, and mechanical fastening.
- f. Inspection of application of bitumen, aggregate, and walkways.
- g. Cutout sampling and analysis as directed.

-- End of Section --

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SECTION 07600

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**04/00**

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CEGS-07600 (April 2000)

SECTION 07600

SHEET METALWORK, GENERAL  
**04/00**

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

|             |  |
|-------------|--|
| ASTM A 167  | (1999) Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip                        |
| ASTM B 32   | (1996) Solder Metal  |
| ASTM B 209  | (1996) Aluminum and Aluminum-Alloy Sheet and Plate   |
| ASTM B 221  | (1996) Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes                        |
| ASTM B 370  | (1998) Copper Sheet and Strip for Building Construction  |
| ASTM D 226  | (1997a) Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing                                 |
| ASTM D 1784 | (1999a) Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds |
| ASTM D 2822 | (1991; R 1997e1) Asphalt Roof Cement   |
| ASTM D 4022 | (1994) Coal Tar Roof Cement, Asbestos Containing   |
| ASTM D 4586 | (1993) Asphalt Roof Cement, Asbestos Free  |

SHEET METAL & AIR CONDITIONING CONTRACTORS NATIONAL ASSOCIATION  
(SMACNA)

SMACNA Arch. Manual (1993; Errata; Addenda Oct 1997)  
Architectural Sheet Metal Manual

## 1.2 GENERAL REQUIREMENTS

Sheet metalwork not being provided under Section 07412 NON-STRUCTURAL METAL ROOFING shall be accomplished to form weathertight construction without waves, warps, buckles, fastening stresses or distortion, and shall allow for expansion and contraction. Cutting, fitting, drilling, and other operations in connection with sheet metal required to accommodate the work of other trades shall be performed by sheet metal mechanics. Installation of sheet metal items used in conjunction with roofing shall be coordinated with roofing work to permit continuous roofing operations. Sheet metalwork pertaining to heating, ventilating, and air conditioning is specified in Section 15650 CENTRAL REFRIGERATED AIR-CONDITIONING SYSTEM.

## 1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

### SD-02 Shop Drawings

#### Materials

Drawings of sheet metal items showing weights, gauges or thicknesses; types of materials; expansion-joint spacing; fabrication details; and installation procedures.

## 1.4 DELIVERY, STORAGE, AND HANDLING

Materials shall be adequately packaged and protected during shipment and shall be inspected for damage, dampness, and wet-storage stains upon delivery to the jobsite. Materials shall be clearly labeled as to type and manufacturer. Sheet metal items shall be carefully handled to avoid damage. Materials shall be stored in dry, ventilated areas until immediately before installation.

## PART 2 PRODUCTS

### 2.1 MATERIALS

Lead, lead-coated metal, and galvanized steel shall not be used. Any metal listed by SMACNA Arch. Manual for a particular item may be used, unless otherwise specified or indicated. Materials shall conform to the requirements specified below and to the thicknesses and configurations established in SMACNA Arch. Manual. Different items need not be of the same metal, except that if copper is selected for any exposed item, all exposed items shall be copper.

#### 2.1.1 Accessories

Accessories and other items essential to complete the sheet metal installation, though not specifically indicated or specified, shall be provided.

2.1.2 Aluminum Extrusions

ASTM B 221, Alloy 6063, Temper T5.

2.1.3 Bituminous Cement

Type I asphalt cement conforming to ASTM D 2822 or ASTM D 4586. For coal tar roofing; coal tar cement conforming to ASTM D 4022.

2.1.4 Sealant

Unless otherwise specified, sealant shall be an elastomeric weather resistant sealant as specified in Section 07900 JOINT SEALING.

2.1.5 Fasteners

Fasteners shall be compatible with the fastened material and shall be the type best suited for the application.

2.1.6 Felt

ASTM D 226, Type I.

2.1.7 Polyvinyl Chloride (PVC) Reglets

ASTM D 1784, Class 14333D, 0.075 inch minimum thickness.

2.1.8 Aluminum Alloy Sheet and Plate

ASTM B 209, fluoropolymer color clad, form, alloy, and temper appropriate for use. Use for all sheet metalwork exposed to view in finished structure.

2.1.9 Copper

ASTM B 370, Temper H 00.

2.1.10 Stainless Steel

ASTM A 167, Type 302 or 304; fully annealed, dead soft temper.

2.1.11 Solder

ASTM B 32, 95-5 tin-antimony.

2.1.12 Through-Wall Flashing

- a. Electro-sheet copper not less than 5 ounces, factory coated both sides with acid- and alkali-resistant bituminous compound not less than 6 ounces per square foot or factory covered both sides with

asphalt-saturated cotton fabric, asphalt saturated glass-fiber fabric, or with 40 pound reinforced kraft paper bonded with asphalt.

### PART 3 EXECUTION

#### 3.1 GENERAL REQUIREMENTS

Gutters and downspouts shall be designed and fabricated in conformance with SMACNA Arch. Manual; louvers are specified in Section 10201. Unless otherwise specified or indicated, exposed edges shall be folded back to form a 1/2 inch hem on the concealed side, and bottom edges of exposed vertical surfaces shall be angled to form drips. Bituminous cement shall not be placed in contact with roofing membranes other than built-up roofing.

#### 3.2 EXPANSION JOINTS

Expansion joints shall be provided as specified in SMACNA Arch. Manual. Expansion joints in continuous sheet metal shall be provided at 40 foot intervals for copper and stainless steel and at 32 foot intervals for aluminum, except extruded aluminum gravel stops and fasciae which shall have expansion joints at not more than 12 foot spacing. Joints shall be evenly spaced. An additional joint shall be provided where the distance between the last expansion joint and the end of the continuous run is more than half the required interval spacing.

#### 3.3 PROTECTION OF ALUMINUM

Aluminum shall not be used where it will be in contact with copper or where it will contact water which flows over copper surfaces. Aluminum that will be in contact with wet or pressure-treated wood, mortar, concrete, masonry, or ferrous metals shall be protected against galvanic or corrosive action by one of the following methods:

##### 3.3.1 Paint

Aluminum surfaces shall be solvent cleaned and given one coat of zinc-molybdate primer and one coat of aluminum paint as specified in Section 09900 PAINTING, GENERAL.

##### 3.3.2 Nonabsorptive Tape or Gasket

Nonabsorptive tape or gasket shall be placed between the adjoining surfaces and cemented to the aluminum surface using a cement compatible with aluminum.

#### 3.4 CONNECTIONS AND JOINTING

##### 3.4.1 Soldering

Soldering shall apply to copper, and stainless steel items. Edges of sheet metal shall be pretinned before soldering is begun. Soldering shall be done slowly with well heated soldering irons so as to thoroughly heat the seams and completely sweat the solder through the full width of the seam.

Edges of stainless steel to be pretinned shall be treated with soldering acid flux. Soldering shall follow immediately after application of the flux. Upon completion of soldering, the acid flux residue shall be thoroughly cleaned from the sheet metal with a water solution of washing soda and rinsed with clean water.

#### 3.4.2 Riveting

Joints in aluminum sheets 0.040 inch or less in thickness shall be mechanically made.

#### 3.4.3 Seaming

Flat-lock and soldered-lap seams shall finish not less than 1 inch wide. Unsoldered plain-lap seams shall lap not less than 3 inches unless otherwise specified. Flat seams shall be made in the direction of the flow.

#### 3.5 CLEATS

A continuous cleat shall be provided where indicated or specified to secure loose edges of the sheet metalwork. Butt joints of cleats shall be spaced approximately 1/8 inch apart. The cleat shall be fastened to supporting wood construction with nails evenly spaced not over 12 inches on centers. Where the fastening is to be made to concrete or masonry, screws shall be used and shall be driven in expansion shields set in concrete or masonry.

#### 3.6 GUTTERS AND DOWNSPOUTS

Gutters and downspouts if not provided as part of the SSSMR, shall be installed as indicated. Gutters shall be supported as indicated. Downspouts shall be rigidly attached to the building. Supports for downspouts shall be spaced according to manufacturer's recommendations.

#### 3.7 FLASHINGS

Flashings shall be installed at locations indicated and as specified below. Sealing shall be according to the flashing manufacturer's recommendations.

Flashings shall be installed at intersections of roof with vertical surfaces and at projections through roof, except that flashing for heating and plumbing, including piping, roof, and floor drains, and for electrical conduit projections through roof or walls are specified in other sections. Except as otherwise indicated, counter flashings shall be provided over base flashings. Perforations in flashings made by masonry anchors shall be covered up by an application of bituminous plastic cement at the perforation. Flashing shall be installed on top of joint reinforcement. Flashing shall be formed to direct water to the outside of the system.

##### 3.7.1 Base Flashing

Metal base flashing shall be coordinated with roofing work. Metal base flashing shall be set in plastic bituminous cement over the roofing membrane, nailed to nailing strip, and secured in place on the roof side with nails spaced not more than 3 inches on centers. Metal base flashing shall not be used on built-up roofing.

### 3.7.2 Counter Flashings

Except as otherwise indicated, counter flashings shall be provided over base flashings. Counter flashing shall be installed as shown on the drawings. Where bituminous base flashings are provided, the counter flashing shall extend down as close as practicable to the top of the cant strip. Counter flashing shall be factory formed to provide spring action against the base flashing.

### 3.7.3 Stepped Flashing

Stepped flashing shall be installed where sloping roofs surfaced with shingles abut vertical surfaces. Separate pieces of base flashing shall be placed in alternate shingle courses.

### 3.7.4 Through-Wall Flashing

Through-wall flashing includes sill, lintel, and spandrel flashing. The flashing shall be laid with a layer of mortar above and below the flashing so that the total thickness of the two layers of the mortar and flashing are the same thickness as the regular mortar joints. Flashing shall not extend further into the masonry backup wall than the first mortar joint. Joints in flashing shall be lapped and sealed. Flashing shall be one piece for lintels and sills.

#### 3.7.4.1 Lintel Flashing

Lintel flashing shall extend the full length of lintel. Flashing shall extend through the wall one masonry course above the lintels and shall be bent down over the vertical leg of the outer steel lintel angle not less than 2 inches, or shall be applied over top of masonry and precast concrete lintels. Bedjoints of lintels at control joints shall be underlaid with sheet metal bond breaker.

#### 3.7.4.2 Sill Flashing

Sill flashing shall extend the full width of the sill and not less than 4 inches beyond ends of sill except at control joint where the flashing shall be terminated at the end of the sill.

3.8 OMITTED

3.9 OMITTED

### 3.10 REGLETS

Reglets shall be a factory fabricated product of proven design, complete with fittings and special shapes as required. Open-type reglets shall be filled with fiberboard or other suitable separator to prevent crushing of the slot during installation. Reglet plugs shall be spaced not over 12 inches on centers and reglet grooves shall be filled with sealant. Friction or slot-type reglets shall have metal flashings inserted the full depth of slot and shall be lightly punched every 12 inches to crimp the reglet and counter flashing together. Polyvinyl chloride reglets shall be

sealed with the manufacturer's recommended sealant.

### 3.11 CONTRACTOR QUALITY CONTROL

The Contractor shall establish and maintain a quality control procedure for sheet metal used in conjunction with roofing to assure compliance of the installed sheet metalwork with the contract requirements. Any work found not to be in compliance with the contract shall be promptly removed and replaced or corrected in an approved manner. Quality control shall include, but not be limited to, the following:

- a. Observation of environmental conditions; number and skill level of sheet metal workers; condition of substrate.
- b. Verification of compliance of materials before, during, and after installation.
- c. Inspection of sheet metalwork for proper size and thickness, fastening and joining, and proper installation.

The actual quality control observations and inspections shall be documented and a copy of the documentation furnished to the Contracting Officer at the end of each day.

-- End of Section --

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SECTION 07840

FIRESTOPPING

**08/00**

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CEGS-07840 (August 2000)

SECTION 07840

FIRESTOPPING  
08/00

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

|             |  |
|-------------|--|
| ASTM E 84   | (1999) Surface Burning Characteristics of Building Materials   |
| ASTM E 119  | (1998) Fire Tests of Building Construction and Materials   |
| ASTM E 814  | (1997) Fire Tests of Through-Penetration Fire Stops  |
| ASTM E 1399 | (1997) Cyclic Movement and Measuring the Minimum and Maximum Joint Widths of Architectural Joint Systems |

UNDERWRITERS LABORATORIES (UL)

|                    |  |
|--------------------|--|
| UL 723             | (1996; Rev thru Dec 1998) Test for Surface Burning Characteristics of Building Materials |
| UL 1479            | (1994; Rev thru Feb 1998) Fire Tests of Through-Penetration Firestops                    |
| UL 2079            | (1998) Tests for Fire Resistance of Building Joint Systems                               |
| UL Fire Resist Dir | (1999) Fire Resistance Directory (2 Vol.)  |

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be

submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Firestopping Materials.

Detail drawings including manufacturer's descriptive data, typical details conforming to UL Fire Resist Dir or other details certified by another nationally recognized testing laboratory, installation instructions or UL listing details for a firestopping assembly in lieu of fire-test data or report. For those firestop applications for which no UL tested system is available through a manufacturer, a manufacturer's engineering judgement, derived from similar UL system designs or other tests, shall be submitted for review and approval prior to installation. Submittal shall indicate the firestopping material to be provided for each type of application. When more than 5 penetrations or construction joints are to receive firestopping, drawings shall indicate location and type of application.

SD-07 Certificates

Firestopping Materials.

Certificates attesting that firestopping material complies with the specified requirements. In lieu of certificates, drawings showing UL classified materials as part of a tested assembly may be provided. Drawings showing evidence of testing by an alternate nationally recognized independent laboratory may be substituted.

Installer Qualifications.

Documentation of training and experience.

Inspection.

Manufacturer's representative certification stating that firestopping work has been inspected and found to be applied according to the manufacturer's recommendations and the specified requirements.

1.3 GENERAL REQUIREMENTS

Firestopping shall consist of furnishing and installing tested and listed firestop systems, combination of materials, or devices to form an effective barrier against the spread of flame, smoke and gases, and maintain the integrity of fire resistance rated walls, partitions, floors, and ceiling-floor assemblies, including through-penetrations and construction joints and gaps. Through-penetrations include the annular space around pipes, tubes, conduit, wires, cables and vents. Construction joints include those used to accommodate expansion, contraction, wind, or seismic movement; firestopping material shall not interfere with the required movement of the joint. Gaps requiring firestopping include gaps between the curtain wall and the floor slab and between the top of the fire-rated

walls and the roof or floor deck above.

#### 1.4 STORAGE AND DELIVERY

Materials shall be delivered in the original unopened packages or containers showing name of the manufacturer and the brand name. Materials shall be stored off the ground and shall be protected from damage and exposure to elements. Damaged or deteriorated materials shall be removed from the site.

#### 1.5 INSTALLER QUALIFICATIONS

The Contractor shall engage an experienced Installer who is certified, licensed, or otherwise qualified by the firestopping manufacturer as having the necessary staff, training, and a minimum of 3 years experience in the installation of manufacturer's products per specified requirements. A manufacturer's willingness to sell its firestopping products to the Contractor or to an installer engaged by the Contractor does not in itself confer qualification on the buyer. The Installer shall have been trained by a direct representative of the manufacturer (not distributor or agent) in the proper selection and installation procedures.

#### 1.6 COORDINATION

The specified work shall be coordinated with other trades. Firestopping materials, at penetrations of pipes and ducts, shall be applied prior to insulating, unless insulation meets requirements specified for firestopping. Firestopping materials at building joints and construction gaps shall be applied prior to completion of enclosing walls or assemblies.

Cast-in-place firestop devices shall be located and installed in place before concrete placement. Pipe, conduit or cable bundles shall be installed through cast-in-place device after concrete placement but before area is concealed or made inaccessible.

### PART 2 PRODUCTS

#### 2.1 FIRESTOPPING MATERIALS

Firestopping materials shall consist of commercially manufactured, asbestos-free products complying with the following minimum requirements:

##### 2.1.1 Fire Hazard Classification

Material shall have a flame spread of 25 or less, and a smoke developed rating of 50 or less, when tested in accordance with ASTM E 84 or UL 723. Material shall be an approved firestopping material as listed in UL Fire Resist Dir or by a nationally recognized testing laboratory.

##### 2.1.2 Toxicity

Material shall be nontoxic to humans at all stages of application.

##### 2.1.3 Fire Resistance Rating

Firestopping will not be required to have a greater fire resistance rating than that of the assembly in which it is being placed.

#### 2.1.3.1 Through-Penetrations

Firestopping materials for through-penetrations, as described in paragraph GENERAL REQUIREMENTS, shall provide "F" and "T" fire resistance ratings in accordance with ASTM E 814 or UL 1479. Fire resistance ratings shall be as follows:

- a. Penetrations of Fire Resistance Rated Walls and Partitions: F Rating = Rating of wall or partition being penetrated.
- b. Penetrations of Fire Resistance Rated Floors, Roof-Ceiling Assemblies and Ceiling-Floor Assemblies: F Rating = 1 hour, T Rating = 1 hour.

#### 2.1.3.2 Construction Joints and Gaps

Fire resistance ratings of construction joints, as described in paragraph GENERAL REQUIREMENTS, and gaps such as those between floor slabs or roof decks and curtain walls shall be the same as the construction in which they occur. Construction joints and gaps shall be provided with firestopping materials and systems that have been tested per ASTM E 119 or UL 2079 to meet the required fire resistance rating. Systems installed at construction joints shall meet the cycling requirements of ASTM E 1399 or UL 2079.

### PART 3 EXECUTION

#### 3.1 PREPARATION

Areas to receive firestopping shall be free of dirt, grease, oil, or loose materials which may affect the fitting or fire resistance of the firestopping system. For cast-in-place firestop devices, formwork or metal deck to receive device prior to concrete placement shall be sound and capable of supporting device.

#### 3.2 INSTALLATION

Firestopping material shall completely fill void spaces regardless of geometric configuration, subject to tolerance established by the manufacturer. Firestopping systems for filling floor voids 4 inches or more in any direction shall be capable of supporting the same load as the floor is designed to support or shall be protected by a permanent barrier to prevent loading or traffic in the firestopped area. Firestopping shall be installed in accordance with manufacturer's written instructions. Tested and listed firestop systems shall be provided in the following locations, except in floor slabs on grade:

- a. Penetrations of duct, conduit, tubing, cable and pipe through floors and through fire-resistance rated walls, partitions, and ceiling-floor assemblies.

- b. Penetrations of vertical shafts such as pipe chases, elevator shafts, and utility chutes.
- c. Gaps at the intersection of floor slabs and curtain walls, including inside of hollow curtain walls at the floor slab.
- d. Gaps at perimeter of fire-resistance rated walls and partitions, such as between the top of the walls and the bottom of roof decks.
- e. Construction joints in floors and fire rated walls and partitions.
- f. Other locations where required to maintain fire resistance rating of the construction.

#### 3.2.1 Insulated Pipes and Ducts

Thermal insulation shall be cut and removed where pipes or ducts pass through firestopping, unless insulation meets requirements specified for firestopping. Thermal insulation shall be replaced with a material having equal thermal insulating and firestopping characteristics.

#### 3.2.2 Fire Dampers

Fire dampers shall be installed and firestopped in accordance with Section 15895 AIR SUPPLY, DISTRIBUTION, VENTILATION, AND EXHAUST SYSTEM.

#### 3.3 INSPECTION

Firestopped areas shall not be covered or enclosed until inspection is complete and approved. A manufacturer's representative shall inspect the applications initially to ensure adequate preparations (clean surfaces suitable for application, etc.) and periodically during the work to assure that the completed work has been accomplished according to the manufacturer's written instructions and the specified requirements.

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SECTION 07900

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**06/97**

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CEGS-07900 (June 1997)

Includes changes through Notice 2 (June 2000)

SECTION 07900

JOINT SEALING

**06/97**

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

|             |  |
|-------------|--|
| ASTM C 509  | (1994) Elastomeric Cellular Preformed Gasket and Sealing Material                            |
| ASTM C 570  | (1995) Oil- and Resin-Base Caulking Compound for Building Construction                       |
| ASTM C 734  | (1993) Low-Temperature Flexibility of Latex Sealants After Artificial Weathering             |
| ASTM C 834  | (1995) Latex Sealants  |
| ASTM C 920  | (1998) Elastomeric Joint Sealants  |
| ASTM C 1085 | (1991) Butyl Rubber-Based Solvent-Release Sealants   |
| ASTM D 217  | (1997) Cone Penetration of Lubricating Grease (IP50/88)                                      |
| ASTM D 1056 | (1998) Flexible Cellular Materials - Sponge or Expanded Rubber                               |
| ASTM D 1565 | (1999) Flexible Cellular Materials - Vinyl Chloride Polymers and Copolymers (Open-Cell Foam) |
| ASTM E 84   | (1999) Surface Burning Characteristics of Building Materials                                 |

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation;



submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-03 Product Data

Backing  
Bond-Breaker  
Sealant

Manufacturer's descriptive data including storage requirements, shelf life, curing time, instructions for mixing and application, and primer data (if required). A copy of the Material Safety Data Sheet shall be provided for each solvent, primer or sealant material.

SD-07 Certificates

Sealant.

Certificates of compliance stating that the materials conform to the specified requirements.

1.3 ENVIRONMENTAL REQUIREMENTS

The ambient temperature shall be within the limits of 40 to 90 degrees F when the sealants are applied.

1.4 DELIVERY AND STORAGE

Materials shall be delivered to the job in the manufacturer's original unopened containers. The container label or accompanying data sheet shall include the following information as applicable: manufacturer, name of material, formula or specification number, lot number, color, date of manufacture, mixing instructions, shelf life, and curing time at the standard conditions for laboratory tests. Materials shall be handled and stored to prevent inclusion of foreign materials. Materials shall be stored at temperatures between 40 and 90 degrees F unless otherwise specified by the manufacturer.

PART 2 PRODUCTS

2.1 BACKING

Backing shall be 25 to 33 percent oversize for closed cell and 40 to 50 percent oversize for open cell material, unless otherwise indicated.

2.1.1 Omitted

2.1.2 PVC

Polyvinyl chloride (PVC) backing shall be ASTM D 1565, Grade VO 12, open-cell foam, round cross section.

#### 2.1.3 Synthetic Rubber

Synthetic rubber backing shall be ASTM C 509, Option I, Type I preformed rods or tubes.

#### 2.1.4 Neoprene

Neoprene backing shall be ASTM D 1056, closed cell expanded neoprene cord Type 2, Class C, Grade 2C2.

#### 2.2 BOND-BREAKER

Bond-breaker shall be as recommended by the sealant manufacturer to prevent adhesion of the sealant to backing or to bottom of the joint.

#### 2.3 PRIMER

Primer shall be non-staining type as recommended by sealant manufacturer for the application.

#### 2.4 CAULKING

Oil- and resin-based caulking shall be ASTM C 570, Type S, Use NT.

#### 2.5 SEALANT

##### 2.5.1 LATEX

Latex Sealant shall be ASTM C 834.

##### 2.5.2 ELASTOMERIC

Elastomeric sealants shall conform to ASTM C 920 and the following:

- a. Polyurethane sealant: Grade NS or P, Class 25, Use T or NT, M, G, A and O.

##### 2.5.3 ACOUSTICAL

Rubber or polymer-based acoustical sealant shall have a flame spread of 25 or less and a smoke developed rating of 50 or less when tested in accordance with ASTM E 84. Acoustical sealant shall have a consistency of 250 to 310 when tested in accordance with ASTM D 217, and shall remain flexible and adhesive after 500 hours of accelerated weathering as specified in ASTM C 734, and shall be non-staining.

##### 2.5.4 BUTYL

Butyl sealant for bedding of thresholds shall be ASTM C 1085.

##### 2.5.5 PREFORMED

Preformed sealant shall be polybutylene or isoprene-butylene based pressure sensitive weather resistant tape or bead sealant capable of sealing out

moisture, air and dust when installed as recommended by the manufacturer. At temperatures from minus 30 to plus 160 degrees F, the sealant shall be non-bleeding and shall have no loss of adhesion.

#### 2.5.5.1 Tape

Tape sealant: cross-section dimensions shall be as indicated.

### 2.6 SOLVENTS AND CLEANING AGENTS

Solvents, cleaning agents, and accessory materials shall be provided as recommended by the manufacturer.

## PART 3 EXECUTION

### 3.1 GENERAL

#### 3.1.1 Surface Preparation

The surfaces of joints to receive sealant or caulk shall be free of all frost, condensation and moisture. Oil, grease, dirt, chalk, particles of mortar, dust, loose rust, loose mill scale, and other foreign substances shall be removed from surfaces of joints to be in contact with the sealant.

Oil and grease shall be removed with solvent and surfaces shall be wiped dry with clean cloths. For surface types not listed below, the sealant manufacturer shall be contacted for specific recommendations.

#### 3.1.2 Concrete and Masonry Surfaces

Where surfaces have been treated with curing compounds, oil, or other such materials, the materials shall be removed by sandblasting or wire brushing. Laitance, efflorescence and loose mortar shall be removed from the joint cavity.

#### 3.1.3 Steel Surfaces

Steel surfaces to be in contact with sealant shall be sandblasted or, if sandblasting would not be practical or would damage adjacent finish work, the metal shall be scraped and wire brushed to remove loose mill scale. Protective coatings on steel surfaces shall be removed by sandblasting or by a solvent that leaves no residue.

#### 3.1.4 Aluminum Surfaces

Aluminum surfaces to be in contact with sealants shall be cleaned of temporary protective coatings. When masking tape is used for a protective cover, the tape and any residual adhesive shall be removed just prior to applying the sealant. Solvents used to remove protective coating shall be as recommended by the manufacturer of the aluminum work and shall be non-staining.

#### 3.1.5 Wood Surfaces

Wood surfaces to be in contact with sealants shall be free of splinters and

sawdust or other loose particles.

### 3.2 APPLICATION

#### 3.2.1 Masking Tape

Masking tape may be placed on the finish surface on one or both sides of a joint cavity to protect adjacent finish surfaces from primer or sealant smears. Masking tape shall be removed within 10 minutes after joint has been filled and tooled.

#### 3.2.2 Backing

Backing shall be installed to provide the indicated sealant depth. The installation tool shall be shaped to avoid puncturing the backing.

#### 3.2.3 Bond-Breaker

Bond-breaker shall be applied to fully cover the bottom of the joint without contaminating the sides where sealant adhesion is required.

#### 3.2.4 Primer

Primer shall be used on concrete masonry units, wood, or other porous surfaces in accordance with instructions furnished with the sealant. Primer shall be applied to the joint surfaces to be sealed. Surfaces adjacent to joints shall not be primed.

#### 3.2.5 Sealant

Sealant shall be used before expiration of shelf life. Multi-component sealants shall be mixed according to manufacturer's printed instructions. Sealant in guns shall be applied with a nozzle of proper size to fit the width of joint. Joints shall be sealed as detailed in the drawings. Sealant shall be forced into joints with sufficient pressure to expel air and fill the groove solidly. Sealant shall be installed to the indicated depth without displacing the backing. Unless otherwise indicated, specified, or recommended by the manufacturer, the installed sealant shall be dry tooled to produce a uniformly smooth surface free of wrinkles and to ensure full adhesion to the sides of the joint; the use of solvents, soapy water, etc., will not be allowed. Sealants shall be installed free of air pockets, foreign embedded matter, ridges and sags. Sealer shall be applied over the sealant when and as specified by the sealant manufacturer.

### 3.3 CLEANING

The surfaces adjoining the sealed joints shall be cleaned of smears and other soiling resulting from the sealant application as work progresses.

### 3.4 SCHEDULE

| Type of Sealant | Location              |
|-----------------|-----------------------|
| caulking        | Glazing in wood doors |

|                      |   |
|----------------------|---|
| Latex Sealant        | Interior non-moving joints  |
| Polyurethane Sealant | All interior joints, door and<br>window frames, interior<br>movement joints |
| Acoustical Sealant   | Acoustical ceiling perimeters,<br>elsewhere as indicated                    |
| Butyl Sealant        | Bedding for metal thresholds  |
| Tape Sealant         | Precast concrete joints<br>except as noted otherwise.                       |

-- End of Section --

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SECTION 08110

STEEL DOORS AND FRAMES

10/00

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CEGS-08110 (October 2000)

SECTION 08110

STEEL DOORS AND FRAMES

10/00

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

- |             |   |
|-------------|---|
| ANSI A250.6 | (1997) Hardware on Steel Doors<br>(Reinforcement - Application) |
| ANSI A250.8 | (1998) Standard Steel Doors and Frames                          |

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

- |             |   |
|-------------|---|
| ASTM C 236  | (1989; R 1993e1) Steady-State Thermal<br>Performance of Building Assemblies by<br>Means of a Guarded Hot Box  |
| ASTM C 976  | (1990; R 1996e) Thermal Performance of<br>Building Assemblies by Means of a<br>Calibrated Hot Box   |
| ASTM D 2863 | (1997) Measuring the Minimum Oxygen<br>Concentration to Support Candle-Like<br>Combustion of Plastics (Oxygen Index)  |
| ASTM E 90   | (1999) Laboratory Measurement of Airborne<br>Sound Transmission Loss of Building<br>Partitions  |
| ASTM E 283  | (1991) Determining the Rate of Air Leakage<br>Through Exterior Windows, Curtain Walls,<br>and Doors Under Specified Pressure<br>Differences Across the Specimen |

DOOR AND HARDWARE INSTITUTE (DHI)

- |             |   |
|-------------|---|
| DHI A115.1G | (1994) Installation Guide for Doors and<br>Hardware |
|-------------|---|

NATIONAL ASSOCIATION OF ARCHITECTURAL METAL MANUFACTURERS (NAAMM)

NAAMM HMMA 865 (1995) Hollow Metal Manual; Section: Guide  
Specifications for Swinging Sound Control  
Hollow Metal Doors and Frames

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 80 (1999) Fire Doors and Fire Windows  
NFPA 80A (1996) Protection of Buildings from  
Exterior Fire Exposures  
NFPA 101 (2000) Life Safety Code  
NFPA 252 (1999) Fire Tests of Door Assemblies

STEEL DOOR INSTITUTE (SDOI)

SDOI SDI-106 (1999) Standard Door Type Nomenclature  
SDOI SDI-128 (1997) Guidelines for Acoustical  
Performance of Standard Steel Doors and  
Frames

UNDERWRITERS LABORATORIES (UL)

UL 10B (1997) Fire Tests of Door Assemblies

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Doors and Frames

Drawings using standard door type nomenclature in accordance with SDOI SDI-106 indicating the location of each door and frame, elevation of each model of door and frame, details of construction, method of assembling sections, location and extent of hardware reinforcement, hardware locations, type and location of anchors for frames, and thicknesses of metal. Drawings shall include catalog cuts or descriptive data for the doors, frames, and weatherstripping including air infiltration data and manufacturers printed instructions.

SD-03 Product Data

Fire Rated Doors



A letter by a nationally recognized testing laboratory which identifies the product manufacturer, type, and model; certifying that the laboratory has tested a sample assembly in accordance with UL 10B or NFPA 252 and issued a current listing for same. A250.10.

#### SD-07 Certificates

Fire Rated Doors  
Thermal Insulated Doors  
Sound Rated Doors

a. Certification of Sound and Thermal Insulating Ratings. Certification or test report for sound rated and thermal insulated doors shall show compliance with the specified requirements. The certification, or test report, shall list the parameters and the type of hardware and perimeter seals used to achieve the rating.

### 1.3 DELIVERY AND STORAGE

During shipment, welded unit type frames shall be strapped together in pairs with heads at opposite ends or shall be provided with temporary steel spreaders at the bottom of each frame; and knockdown type frames shall be securely strapped in bundles. Materials shall be delivered to the site in undamaged condition, and stored out of contact with the ground and under a weathertight covering permitting air circulation. Doors and assembled frames shall be stored in an upright position in accordance with DHI A115.1G. Abraded, scarred, or rusty areas shall be cleaned and touched up with matching finishes.

### 1.4 WARRANTY

Manufacturer's standard performance guarantees or warranties that extend beyond a 1 year period shall be provided.

## PART 2 PRODUCTS

### 2.1 DOORS AND FRAMES

Doors and frames shall be factory fabricated in accordance with ANSI A250.8 and the additional requirements specified herein. Door Level shall be extra heavy duty (Level 3) unless otherwise indicated on the door and door frame schedules. Exterior doors and frames shall be designation A60 galvanized. Doors and frames shall be prepared to receive hardware conforming to the templates and information provided under Section 08700 BUILDERS' HARDWARE. Doors and frames shall be reinforced, drilled, and tapped to receive mortised hinges, locks, latches, and flush bolts as required. Doors and frames shall be reinforced for surface applied hardware. Frames shall be welded type located as shown. Door frames shall be furnished with a minimum of three jamb anchors and one floor anchor per jamb. Anchors shall be not less than 7 gauge steel or diameter wire. For wall conditions that do not allow the use of a floor anchor, an additional jamb anchor shall be provided. Rubber silencers shall be furnished for installation into factory predrilled holes in door frames; adhesively

applied silencers are not acceptable. Where frames are installed in plaster or masonry walls, plaster guards shall be provided on door frames at hinges and strikes. Full glass doors shall conform to ANSI A250.8 and shall include provisions for glazing. Reinforcing of door assemblies for closers and other required hardware shall be in accordance with ANSI A250.8 and the conditions of the fire door assembly listing when applicable. Exterior doors shall have top edges closed flush and sealed against water penetration.

## 2.2 FIRE RATED DOORS

Fire rated door assemblies shall bear the listing identification label of a nationally recognized testing laboratory qualified to perform tests of fire door assemblies in accordance with UL 10B and NFPA 252 and having a listing for the tested assemblies. The fire resistance rating shall be as shown. Doors exceeding the sizes for which listing label service is offered shall be in accordance with UL 10B. Listing identification labels shall be constructed and permanently applied by a method which results in their destruction should they be removed.

## 2.3 THERMAL INSULATED DOORS

The thermal insulated doors shall have a minimum insulation value of R10. The interior of thermal insulated doors shall be filled with rigid plastic foam permanently bonded to each face panel. The thermal conductance (U-value) through the door shall not exceed 0.41 btu/hr times sq f times f when tested as an operational assembly in accordance with ASTM C 236 or ASTM C 976. Doors with cellular plastic cores shall have a minimum oxygen index rating of 22 percent when tested in accordance with ASTM D 2863 Provide for all exterior hollow metal doors..

## 2.4 OMITTED

## 2.5 SOUND RATED DOORS

Sound rated doors and frames shall be complete assemblies furnished by a single vendor, factory fabricated in accordance with SDOI SDI-128 or NAAMM HMMA 865 and shall be provided at locations shown on the drawings. Door assemblies shall consist of 16 gauge minimum thickness door, 14 gauge minimum thickness frame, and adjustable perimeter seals. The Sound Transmission Class rating of the assembly shall be as shown on the drawings when tested in accordance with ASTM E 90. Doors shall have increased backset to accommodate seals.

## 2.6 WEATHERSTRIPPING

Unless otherwise specified in Section 08700 BUILDERS' HARDWARE, weatherstripping shall be as follows: Weatherstripping for head and jamb shall be manufacturer's standard elastomeric type of synthetic rubber, vinyl, or neoprene and shall be installed at the factory or on the jobsite in accordance with the door frame manufacturer's recommendations. Weatherstripping for bottom of doors shall be as shown. Air leakage rate of weatherstripping shall not exceed 0.20 cfm per linear foot of crack when tested in accordance with ASTM E 283 at standard test conditions.

## 2.7 OMITTED

## 2.8 LOUVERS

Where indicated, doors shall be provided with full louvers. Louvers shall be sightproof type inserted into the door. Pierced louvers shall not be used on exterior doors. Inserted louvers shall be stationary. Louvers shall be nonremovable from the outside of exterior doors or the unsecure side of interior doors. Insect screens shall be a removable type with 18 by 16 mesh aluminum or bronze cloth. Full louver doors shall be in accordance with ANSI A250.8.

## 2.9 GLAZING

Glazing shall be as specified in Section 08810 GLASS AND GLAZING. Removable glazing beads shall be screw-on or snap-on type.

## 2.10 FACTORY FINISH

Doors and frames shall be phosphatized and primed with standard factory primer system. Color shall be as shown on the drawings.

# PART 3 EXECUTION

## 3.1 GENERAL REQUIREMENTS

Installation shall not begin until temperature and humidity conditions closely approximate interior conditions which will exist when area is complete and occupied; heating and air conditioning shall be operating prior to, during, and after installation. Contractor shall coordinate the work with that of other trades and shall verify opening dimensions with contract and shop drawings. Each frame shall be installed plumb and square using door as template; the frame shall be secured to the wall in accordance with the manufacturer's instructions. All damaged or defective frames shall be repaired/replaced prior to final inspection.

## 3.2 INSTALLATION

Installation shall be in accordance with DHI A115.1G. Preparation for surface applied hardware shall be in accordance with ANSI A250.6. Rubber silencers shall be installed in door frames after finish painting has been completed; adhesively applied silencers are not acceptable. Weatherstripping shall be installed at exterior door openings to provide a weathertight installation. Installation and operational characteristics of fire doors shall be in accordance with NFPA 80, NFPA 80A and NFPA 101. Hollow metal door frames shall be solid grouted as shown.

### 3.2.1 Thermal Insulated Doors

Hardware and perimeter seals shall be adjusted for proper operation. Doors shall be sealed weathertight after installation of hardware and shall be in accordance with Section 07900 JOINT SEALING.

3.2.2 Omitted

Door frames shall be rigidly anchored in place and provided with antispread space filler reinforcements to prevent disengagement of the lock bolt by prying or jacking of the frame. Jambs shall be filled solid with concrete grout.

3.2.3 Sound Rated Doors

Sound rated doors shall be installed in accordance with the manufacturer's printed instructions. Hardware and perimeter seals shall be adjusted for proper operation.

3.3 FIELD PAINTED FINISH

Steel doors and frames shall be field painted in accordance with Section 09900 PAINTING, GENERAL. Weatherstrips shall be protected from paint. Finish shall be free of scratches or other blemishes. Color shall be as shown on the drawings.

-- End of Section --

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SECTION 08210

WOOD DOORS

**08/00**

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CEGS-08210 (August 2000)

Includes changes through Notice 1 (November 2000)

## SECTION 08210

### WOOD DOORS

**08/00**

#### PART 1 GENERAL

##### 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

##### AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

|           |  |
|-----------|--|
| ASTM E 90 | (1999) Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions |
|-----------|--|

##### NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

|          |                                      |
|----------|--------------------------------------|
| NFPA 80  | (1999) Fire Doors and Fire Windows   |
| NFPA 101 | (2000) Life Safety Code              |
| NFPA 252 | (1999) Fire Tests of Door Assemblies |

##### NATIONAL WOOD WINDOW & DOOR ASSOCIATION (NWWDA)

|                |                                       |
|----------------|---------------------------------------|
| NWWDA I.S. 1-A | (1997) Architectural Wood Flush Doors |
|----------------|---------------------------------------|

##### 1.2 GENERAL REQUIREMENTS

###### 1.2.1 Standard Products

Doors shall be of the type, size, and design indicated on the drawings, and shall be the standard products of manufacturers regularly engaged in the manufacture of wood doors.

###### 1.2.2 Marking

Each door shall bear a stamp, brand, or other identifying mark indicating quality and construction of the door. The identifying mark or a separate certification shall include identification of the standard on which construction of the door is based, identity of the manufacturing plant, identification of the standard under which preservative treatment, if used, was made, and identification of the doors having a Type I glue bond.

### 1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

#### SD-02 Shop Drawings

##### Wood Doors

Drawings indicating the location of each door, elevation of each type of door, details of construction, marks to be used to identify the doors, and location and extent of hardware blocking. Drawings shall include catalog cuts or descriptive data for doors, weatherstripping, flashing, and thresholds to be used.

##### Fire Doors

Manufacturers preprinted installation and touch-up instructions.

### 1.4 STORAGE

Doors shall be stored in fully covered areas and protected from damage and from extremes in temperature and humidity. Doors shall be stored on supports to prevent warping or twisting, and to provide ventilation. Factory cartons or wrappers shall be kept intact until installation.

### 1.5 HARDWARE

Hardware, including weatherstripping and thresholds, is specified in Section 08700 BUILDERS' HARDWARE.

### 1.6 GLAZING

Glazing is specified in Section 08810 GLASS AND GLAZING.

### 1.7 WARRANTY

Manufacturer's standard performance guarantees or warranties that extend beyond a 1 year period shall be provided.

## PART 2 PRODUCTS

### 2.1 GENERAL FABRICATION REQUIREMENTS

#### 2.1.1 Edge Sealing

Wood end-grain exposed at edges of doors shall be sealed prior to shipment.

#### 2.1.2 Omitted



### 2.1.3 Adhesives

Adhesives shall be in accordance with NWWDA I.S. 1-A, requirements for Type II Bond Doors (water-repellent). Adhesive for doors to receive a transparent finish shall be nonstaining. Adhesives shall contain no formaldehydes.

### 2.1.4 Prefitting

Doors shall be furnished prefitted or unfitted at the option of the Contractor, except sound-rated door assemblies shall be furnished prefit in accordance with the standards under which they are produced.

## 2.2 FLUSH DOORS

Flush doors shall be solid core and shall conform to NWWDA I.S. 1-A, except for the one year acclimatization requirement in paragraph T-2, which shall not apply. Wood doors shall be 5-ply construction with faces, stiles, and rails bonded to the cores.

### 2.2.1 Core Construction

#### 2.2.1.1 Solid Cores

Door construction shall be glued wood block core or particle board core with vertical and horizontal edges bonded to the core. Blocking and hardware reinforcements for particle board and mineral core doors shall be blocking option HB-6 in accordance with NWWDA I.S. 1-A.

### 2.2.2 Face Panels

#### 2.2.2.1 Natural Finished Wood Veneer Doors

Veneer doors to receive natural finish shall be Custom Grade red oak veneer in accordance with NWWDA I.S. 1-A. Vertical stile strips shall be selected to provide edges of compatible species Door finish shall be in accordance with paragraph FIELD FINISHING.

## 2.3 OMITTED

## 2.4 FIRE RATED DOORS

Fire rated door assemblies shall bear the listing identification label of a nationally recognized testing laboratory qualified to perform tests of fire door assemblies in accordance with NFPA 252 and having a listing for the tested assemblies. The specific time interval rating on the labels shall be as shown. Door assemblies shall be in accordance with NFPA 80. Listing identification on labels shall be constructed and permanently applied by a method which results in their destruction should they be removed. Fire rated doors shall be particleboard core 20 minute rating.

### 2.4.1 Reinforcement Blocking

Fire rated doors shall be provided, as required, with hardware

reinforcement blocking, and top, bottom, and intermediate rail blocking. Lock blocks shall be not less than 5 inches by 18 inches. Reinforcement blocking shall be in compliance with the manufacturer's labeling requirements. Reinforcement blocking shall not be of mineral material.

#### 2.4.2 Stile Edges

Composite fire rated doors shall be provided with vertical stile edges that do not contain fire retardant salts. Vertical stiles shall be of the same species and/or color as the face veneer.

#### 2.5 MOULDING AND EDGING

Moulding and edging shall be as shown. Wood species for transparent finished doors shall be compatible with veneer.

#### 2.6 SOUND RATED DOOR ASSEMBLIES

Sound rated door assemblies shall consist of wood doors, hollow metal frames, and adjustable perimeter seals. Assemblies shall be furnished as complete assemblies from a single vendor and shall have Sound Transmission Class (STC) rating as indicated, tested in accordance with ASTM E 90.

##### 2.6.1 Doors

Solid core, as specified in Paragraph FLUSH DOORS, except constructed to achieve STC rating indicated.

##### 2.6.2 Frames

Hollow steel, as specified in Section 08110 STEEL DOORS AND FRAMES.

##### 2.6.3 Perimeter Seals

As standard with the manufacturer of the door assembly to achieve indicated STC rating for the complete assembly.

### PART 3 EXECUTION

#### 3.1 INSTALLATION OF DOORS

##### 3.1.1 General Use Doors

Doors shall be fit, hung, and trimmed as required. Door shall have a clearance of 1/8 inch at the sides and top and shall have a bottom clearance of 1/4 inch over thresholds and 1/2 inch at other locations unless otherwise shown. The lock edge or both edges of doors shall be beveled at the rate of 1/8 inch in 2 inches. Cuts made on the job shall be sealed immediately after cutting, using a clear varnish or sealer. Bottom of doors shall be undercut to allow clear door swing over carpeted areas. Vertical edges of doors which have not been rounded or beveled at the factory shall be eased when the doors are installed.

##### 3.1.2 Fire Doors

Installation, hardware, and operational characteristics shall conform to NFPA 80 and NFPA 101 and shall be in strict conformance with the manufacturer's printed instructions. Properly sized pilot holes shall be drilled for screws in door edges. Factory applied labels shall remain intact where installed. Labeled hinge stile edge and top edge of door shall not be trimmed. Lockstile edge and bottom edge may be trimmed only to the extent recommended by the door manufacturer.

#### 3.1.3 Sound Rated Doors

Sound rated doors shall be installed in accordance with the manufacturer's printed instructions. Hardware and perimeter seals shall be adjusted for proper operation.

#### 3.2 OMITTED

#### 3.3 FIELD FINISHING

Doors to receive field finishing, whether paint or natural finish, shall be factory primed or sealed, as required, and then shall be finished in accordance with Section 09900 PAINTING, GENERAL. Factory applied sealer shall not prevent doors from accepting field stain and finish. Color shall be as shown on drawings. Field touch-up of factory finishes shall be in accordance with manufacturers instructions.

-- End of Section --

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SECTION 08520

ALUMINUM AND ENVIRONMENTAL CONTROL ALUMINUM WINDOWS

03/00

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CEGS-08520 (March 2000)

SECTION 08520

ALUMINUM AND ENVIRONMENTAL CONTROL ALUMINUM WINDOWS  
**03/00**

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

ALUMINUM ASSOCIATION (AA)

AA DAF-45 (1997) Designation System for Aluminum Finishes

AMERICAN ARCHITECTURAL MANUFACTURERS ASSOCIATION (AAMA)

AAMA 101 (1997) Voluntary Specifications for Aluminum, Vinyl (PVC) and Wood Windows and Glass Doors

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM E 283 (1991) Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen

ASTM E 330 (1997e1) Structural Performance of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference

ASTM E 331 (1996) Water Penetration of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference

NATIONAL FENESTRATION RATING COUNCIL (NFRC)

NFRC 100 (1997) Procedure for Determining Fenestration Product U-factors

NFRC 200 (1997) Procedure for Determining Fenestration Product Solar Heat Gain

Coefficients at Normal Incidence

1.2 WINDOW PERFORMANCE

Aluminum windows shall meet the following performance requirements. Testing requirements shall be performed by an independent testing laboratory or agency.

1.2.1 Structural Performance

Structural test pressures on window units shall be for positive load (inward) and negative load (outward) in accordance with ASTM E 330. After testing, there shall be no glass breakage, permanent damage to fasteners, hardware parts, support arms or actuating mechanisms or any other damage which could cause window to be inoperable. There shall be no permanent deformation of any main frame, sash or ventilator member in excess of the requirements established by AAMA 101 for the window types and classification specified in this section.

1.2.2 Air Infiltration

Air infiltration shall not exceed the amount established by AAMA 101 for each window type when tested in accordance with ASTM E 283.

1.2.3 Water Penetration

Water penetration shall not exceed the amount established by AAMA 101 for each window type when tested in accordance with ASTM E 331.

1.2.4 Thermal Performance

Thermal transmittance for thermally broken aluminum windows with insulating glass shall not exceed a U-factor of 0.40 Btu/hr-ft<sup>2</sup>-F determined according to NFRC 100, and a solar heat gain coefficient (SHGC) of 0.55 Btu/hr-ft<sup>2</sup>-F determined according to NFRC 200. Window units shall comply with the U.S. Department of Energy, Energy Star Window Program for the Central Climate Zone.

1.2.5 Condensation Index Rating

The condensation index rating shall be 85 as determined using NFRC approved software THERM.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Aluminum Windows

Drawings indicating elevations of window, rough-opening dimensions for each type and size of window, full-size sections, thicknesses of metal, fastenings, methods of installation and anchorage, connections with other work, type of wall construction, size and spacing of anchors, method of glazing, types and locations of operating hardware, mullion details, weatherstripping details, and window schedules showing locations of each window type.

SD-03 Product Data

Aluminum Windows

Manufacturer's descriptive data and catalog cut sheets.

Manufacturer's preprinted installation instructions and cleaning instructions.

SD-06 Test Reports

Aluminum Windows

Reports for each type of aluminum window attesting that identical windows have been tested and meet all performance requirements established under paragraph WINDOW PERFORMANCE.

SD-07 Certificates

Aluminum Windows

Certificates stating that the aluminum windows are AAMA certified conforming to requirements of this section. Labels or markings permanently affixed to the window will be accepted in lieu of certificates. Product ratings determined using NFRC 100 and NFRC 200 shall be authorized for certification and properly labeled by the manufacturer.

1.4 QUALIFICATION

Window manufacturer shall specialize in designing and manufacturing the type of aluminum windows specified in this section, and shall have a minimum of 5 years of documented successful experience. Manufacturer shall have the facilities capable of meeting contract requirements, single-source responsibility and warranty.

1.5 OMITTED

1.6 DELIVERY AND STORAGE

Aluminum windows shall be delivered to project site and stored in accordance with manufacturer's recommendations. Damaged windows shall be replaced with new windows.

## 1.7 WARRANTY

Manufacturer's standard performance guarantees or warranties that extend beyond a 1 year period shall be provided.

## PART 2 PRODUCTS

### 2.1 ALUMINUM WINDOW TYPES

Aluminum windows shall consist of complete units including sash, glass, frame, weatherstripping, and hardware. Windows shall conform to AAMA 101. Windows shall be thermal break type double-glazed. Thermal barrier shall be neoprene, rigid vinyl, or polyurethane and shall be resistant to weather. Window members shall be heli-arc welded or angle-reinforced and mechanically joined and sealed. Exposed welded joints shall be dressed and finished. Joints shall be permanent and weathertight. Frames shall be constructed to provide a minimum 1/4 inch thermal break between the exterior and interior frame surfaces. Sash corners shall be internally sealed to prevent air and water leaks. Operable windows shall permit cleaning the outside glass from inside the building.

#### 2.1.1 Awning/Hopper/Projected Windows

Aluminum projected windows shall conform to AAMA 101 Designation AP-HC40 type consisting of hinged ventilators arranged in a single or vertical series within a common frame. Ventilators shall be operated by a device which shall securely close the ventilator at both jambs without the use of additional manually-controlled locking device. Operating hardware, except ventilator arms and rotary operators, shall be concealed within frame and sill. Ventilator arms shall be concealed when windows are closed.

#### 2.1.2 Omitted

#### 2.1.3 Omitted

#### 2.1.4 Fixed Windows

Aluminum fixed (F) windows shall conform to AAMA 101 F-HC40 type, non-operable glazed frame, complete with provisions for reglazing in the field.

### 2.2 WEATHERSTRIPPING

Weatherstripping for ventilating sections shall be of type designed to meet water penetration and air infiltration requirements specified in this section in accordance with AAMA 101, and shall be manufactured of material compatible with aluminum and resistant to weather. Weatherstrips shall be factory-applied and easily replaced in the field. Neoprene or polyvinylchloride weatherstripping are not acceptable where exposed to direct sunlight.

#### 2.3 OMITTED

#### 2.4 ACCESSORIES



#### 2.4.1 Fasteners

Fastening devices shall be window manufacturer's standard design made from aluminum, non-magnetic stainless steel, cadmium-plated steel, nickel/chrome-plated steel in compliance with AAMA 101. Self-tapping sheet metal screws will not be acceptable for material thicker than 1/16 inch.

#### 2.4.2 Hardware

Hardware shall be as specified for each window type and shall be fabricated of aluminum, stainless steel, cadmium-plated steel, zinc-plated steel or nickel/chrome-plated steel in accordance with requirements established by AAMA 101.

#### 2.4.3 Window Anchors

Anchoring devices for installing windows shall be made of aluminum, cadmium-plated steel, stainless steel, or zinc-plated steel conforming to AAMA 101.

### 2.5 GLASS AND GLAZING

Aluminum windows shall be designed for inside glazing, field glazing, and for glass types scheduled on drawings and specified in Section 08810 GLASS AND GLAZING. Units shall be complete with glass and glazing provisions to meet AAMA 101. Glazing material shall be compatible with aluminum, and shall not require painting.

### 2.6 FINISH

#### 2.6.1 Anodized Aluminum Finish

Exposed surfaces of aluminum windows shall be finished with anodic coating conforming to AA DAF-45: Architectural Class I, AA-M10-C22-A41, clear anodic coating, 0.7 mil or thicker, 215-R1 Natural Color. Finish shall be free of scratches and other blemishes.

## PART 3 EXECUTION

### 3.1 INSTALLATION

Aluminum windows shall be installed in accordance with approved shop drawings and manufacturer's published instructions. Aluminum surfaces in contact with masonry, concrete, wood and dissimilar metals other than stainless steel, zinc, cadmium or small areas of white bronze, shall be protected from direct contact using protective materials recommended by AAMA 101. The completed window installation shall be watertight in accordance with Section 07900 JOINT SEALING. Glass and glazing shall be installed in accordance with requirements of this section and Section 08810 GLASS AND GLAZING.

### 3.2 ADJUSTMENTS AND CLEANING

3.2.1 Hardware Adjustments

Final operating adjustments shall be made after glazing work is complete. Operating sash or ventilators shall operate smoothly and shall be weathertight when in locked position.

3.2.2 Cleaning

Aluminum window finish and glass shall be cleaned on exterior and interior sides in accordance with window manufacturer's recommendations. Alkaline or abrasive agents shall not be used. Precautions shall be taken to avoid scratching or marring window finish and glass surfaces.

-- End of Section --

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SECTION 08700

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03/96

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CEGS-08700 (March 1996)

Includes changes through Notice 6 (May 1999)

SECTION 08700

BUILDERS' HARDWARE  
**03/96**

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

- |            |   |
|------------|---|
| ASTM E 283 | (1991) Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls and Doors Under Specified Pressure Differences Across the Specimen |
| ASTM F 883 | (1997) Padlocks   |

BUILDERS HARDWARE MANUFACTURERS ASSOCIATION (BHMA)

- |                             |  |
|-----------------------------|--|
| BHMA L & R Directory        | (Effective thru Jun 1999) Directory of Certified Locks & Latches |
| BHMA Closer Directory       | (Effective thru Jul (1999) Directory of Certified Door Closers   |
| BHMA Exit Devices Directory | (Effective thru Aug 1998) Directory of Certified Exit Devices    |
| BHMA A156.1                 | (1997) Butts and Hinges  |
| BHMA A156.2                 | (1996) Bored and Preassembled Locks and Latches                  |
| BHMA A156.3                 | (1994) Exit Devices  |
| BHMA A156.4                 | (1992) Door Controls - Closers                                   |
| BHMA A156.5                 | (1992) Auxiliary Locks & Associated Products                     |
| BHMA A156.6                 | (1994) Architectural Door Trim                                   |
| BHMA A156.7                 | (1997) Template Hinge Dimensions                                 |
| BHMA A156.13                | (1994) Mortise Locks & Latches                                   |
| BHMA A156.15                | (1995) Closer Holder Release Devices                             |
| BHMA A156.16                | (1989) Auxiliary Hardware  |
| BHMA A156.18                | (1993) Materials and Finishes                                    |

|              |                                       |
|--------------|---------------------------------------|
| BHMA A156.20 | (1996) Strap and Tee Hinges and Hasps |
| BHMA A156.21 | (1996) Thresholds                     |
| BHMA A156.24 | (1992) Delayed Egress Locks           |

DOOR AND HARDWARE INSTITUTE (DHI)

|                       |   |
|-----------------------|---|
| DHI Keying Systems    | (1989) Keying Systems and Nomenclature  |
| DHI Locations for CSD | (1997) Recommended Locations for Builders' Hardware for Custom Steel Doors and Frames       |
| DHI Locations for SSD | (1990) Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames |
| DHI ANSI/DHI A115.1G  | (1994) Installation Guide for Doors and Hardware  |
| DHI ANSI/DHI A115-W   | (Varies) Wood Door Hardware Standards (Incl A115-W1 thru A115-W9)                           |

FEDERAL SPECIFICATIONS (FS)

|              |                             |
|--------------|-----------------------------|
| FS FF-L-2740 | (Rev. A) Locks, Combination |
|--------------|-----------------------------|

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

|          |  |
|----------|--|
| NFPA 80  | (1999) Fire Doors and Fire Windows                   |
| NFPA 101 | (1997; Errata 97-1; TIA-97-1) Life Safety Code       |
| NFPA 105 | (1999) Installation of Smoke-Control Door Assemblies |

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Drawings; G, RE

Detail drawings for hardware devices for keyless push button and combination dial access control systems, and other electrical hardware devices showing complete wiring and schematic diagrams and other details required to demonstrate proper function of units.

SD-03 Product Data

Exit Device Accessories

Manufacturer's descriptive data, technical literature, catalog cuts, and installation instructions. Spare parts data for locksets, exit devices, closers, electric locks, electric strikes, electro-magnetic closer holder release devices, and electric exit devices, after approval of the detail drawings, and not later than 3 month(s) prior to the date of beneficial occupancy. The data shall include a complete list of parts and supplies, with current unit prices and source of

supply.

#### Hardware Schedule

Hardware schedule listing all items to be furnished. The schedule shall include for each item: the quantities; manufacturer's name and catalog numbers; the ANSI number specified, sizes; detail information or catalog cuts; finishes; door and frame size and materials; location and hardware set identification cross-references to drawings; corresponding reference standard type number or function number from manufacturer's catalog if not covered by ANSI or BHMA; and list of abbreviations and template numbers.

Keying; G, RE

Keying schedule developed in accordance with DHI Keying Systems, after the keying meeting with the user.

#### SD-07 Certificates

##### Hardware and Accessories

The hardware manufacturer's certificates of compliance stating that the supplied material or hardware item meets specified requirements. Each certificate shall be signed by an official authorized to certify in behalf of the product manufacturer and shall identify quantity and date or dates of shipment or delivery to which the certificates apply. A statement that the proposed hardware items appear in BHMA L & R Directory, BHMA Closer Directory and BHMA Exit Devices Directory directories of certified products may be submitted in lieu of certificates.

#### 1.3 PREDELIVERY CONFERENCE

Upon approval of the Hardware Schedule, the construction Contractor shall arrange a conference with the hardware supplier, Contracting Officer and the using agency to determine keying system requirements. Location of the key control storage system, set-up and key identification labeling will also be determined.

#### 1.4 DELIVERY, STORAGE, AND HANDLING

Hardware shall be delivered to the project site in the manufacturer's original packages. Each article of hardware shall be individually packaged in the manufacturer's standard commercial carton or container, and shall be properly marked or labeled to be readily identifiable with the approved hardware schedule. Each change key shall be tagged or otherwise identified with the door for which its cylinder is intended. Where double cylinder functions are used or where it is not obvious which is the key side of a door, appropriate instructions shall be included with the lock and on the hardware schedule. Manufacturer's printed installation instructions, fasteners, and special tools shall be included in each package.

#### 1.5 SPECIAL TOOLS

Special tools, such as those supplied by the manufacturer, unique wrenches, and dogging keys, shall be provided as required to adjust hardware items.

#### 1.6 WARRANTY

Manufacturer's standard performance guarantees or warranties that extend beyond a one year period shall be provided.

## 1.7 OPERATION AND MAINTENANCE MANUALS

Six complete copies of maintenance instructions listing routine maintenance procedures, possible breakdowns and repairs, and troubleshooting guides shall be provided. The instructions for electric locks, electric strikes, electro-magnetic closer holder release devices, and electric exit devices shall include simplified diagrams as installed.

## 1.8 INSTALLER QUALIFICATIONS

Installer of electro-mechanical locks shall be certified by the lock manufacturer as competent to perform the installation and perform all necessary adjustments and calibration.

## PART 2 PRODUCTS

### 2.1 GENERAL HARDWARE REQUIREMENTS

Hardware shall conform to the requirements specified herein and the HARDWARE SETS listing at the end of this section. Hardware set numbers correspond to the set numbers shown on the drawings.

### 2.2 TEMPLATES

Requirements for hardware to be mounted on metal doors or metal frames shall be coordinated between hardware manufacturer and door or frame manufacturer by use of templates and other information to establish location, reinforcement required, size of holes, and similar details. Templates of hinges shall conform to BHMA A156.7.

### 2.3 HINGES

Hinges shall conform to BHMA A156.1. Hinges used on metal doors and frames shall also conform to BHMA A156.7. Except as otherwise specified, hinge sizes shall conform to the hinge manufacturer's printed recommendations.

#### 2.3.1 Hinges for Reverse Bevel Doors with Locks

Hinges for reverse bevel doors with locks shall have pins that are made nonremovable by means such as a set screw in the barrel, or safety stud, when the door is in the closed position.

#### 2.3.2 Contractor's Option

Hinges with antifriction bearings may be furnished in lieu of ball bearing hinges, except where prohibited for fire doors by the requirements of NFPA 80.

#### 2.3.3 Omitted

#### 2.3.4 Omitted

#### 2.3.5 Electric Hinges

Electric hinges shall conform to BHMA A156.1 with modification of added electric wires to insure correct operation of electric hardware items.

## 2.4 LOCKS AND LATCHES

To the maximum extent possible, locksets, latchsets and deadlocks, and all components thereof, including cylinders and removable cores, shall be the products of a single manufacturer. Lock fronts for double-acting doors shall be rounded. Strikes for wood frames and pairs of wood doors shall be furnished



with wrought boxes.

#### 2.4.1 Mortise Lock and Latchsets

Mortise lock, latchsets, and strikes shall be series 1000 and shall conform to BHMA A156.13, operational Grade 1. Strikes for security doors shall be rectangular without curved lip. Mortise type locks and latches for doors 1-3/4 inches thick and over shall have adjustable bevel fronts or otherwise conform to the shape of the door. Mortise locks shall have armored fronts.

#### 2.4.2 Bored Lock and Latchsets

Bored lock, latchsets, and strikes shall be series 4000 and shall conform to BHMA A156.2, Grade 1. Bored type locks and latches for doors 1-3/8 inches thick and over shall have adjustable bevel fronts or otherwise conform to the shape of the door.

#### 2.4.3 Electro-Mechanical Locks

Electro-mechanical locks shall conform to FS FF-L-2740 and allow for unlocking of doors by means of a dial that generates an electrical current to actuate the bolt. requiring no external power source. Locks shall be rim type conforming to BHMA A156.5 with manufactured electro-mechanical locks conforming to BHMA A156.13 or BHMA A156.2 test standards. Where doors with exit devices also require electro-mechanical locks the lock system shall be mated with the exit devices.

#### 2.4.4 Auxiliary Locks and Associated Products

Mortise dead locks and dead latches, narrow style dead locks and dead latches, rim latches, dead latches, and dead bolts, and electric strikes shall conform to BHMA A156.5. Bolt and latch retraction shall be dead bolt style. Strike boxes shall be furnished with dead bolt and latch strikes for Grade 1. Electric strikes shall be unlocked from a remote location in fail secured mode. Electric strike for rated openings shall be fail secured.

#### 2.4.5 Lock Cylinders (Mortise, Rim and Bored)

Lock cylinders shall comply with BHMA A156.5. Lock cylinder shall have not less than seven pins. An extension of the existing keying system shall be provided. The cylinders shall be compatible with existing locks that were manufactured by Best Lock Co., have interchangeable cores and have a security type keyway. Construction interchangeable cores shall be provided. Disassembly of knob or lockset shall not be required to remove core from lockset.

#### 2.4.6 Pushbutton Mechanical Locks

Heavy-duty, mechanical combination lockset with five pushbuttons, standard-sized knobs, 3/4 inch deadlocking latch, 2 3/4 inch backset. Lock shall be operated by pressing two or more of the buttons in unison or individually in the proper sequence. Inside knob shall always operate the latch. Provide a keyed cylinder on the interior to permit setting the combination. Provide a keyed removable-core cylinder on the exterior to permit bypassing the combination.

#### 2.4.7 Padlocks

Padlocks shall conform to ASTM F 883, Type P01, Options A, B and G. Grade 6. . All padlocks shall be keyed into master key system.. Straps, tee hinges, and hasps shall conform to BHMA A156.20.

#### 2.4.8 Omitted

#### 2.4.9 Lock Trim

Lock trim shall be cast, forged, or heavy wrought construction of commercial plain design. In addition to meeting the test requirement of BHMA A156.2 or BHMA A156.13, knobs, lever handles, roses, and escutcheons shall be 0.050 inch thick, if unreinforced. If reinforced, the outer shell shall be 0.035 inch thick and the combined thickness shall be 0.070 inch except that knob shanks shall be 0.060 inch thick. Knob diameter shall be 2-1/8 to 2-1/4 inches. Lever handles shall be of plain design with ends returned to no more than 1/2 inch from the door face.

#### 2.5 EXIT DEVICES AND EXIT DEVICE ACCESSORIES

Exit devices and exit device accessories shall conform to BHMA A156.3, Grade 1.

##### 2.5.1 Exit Devices and Auxiliary Items

Trim shall be of wrought construction and commercial plain design with straight, beveled, or smoothly rounded sides, corners, and edges. Adjustable strikes shall be provided for rim type and vertical rod devices. Open back strikes shall be provided for pairs of doors with mortise and vertical rod devices; except open back strikes shall be used on labeled doors only where specifically provided for in the published listings. Touch bars shall be provided in lieu of conventional crossbars and arms. Escutcheons shall be provided not less than 7 by 2-1/4 inches. Escutcheons shall be cut to suit cylinders and operating trim.

##### 2.5.2 Door Coordinator

Door coordinator with carry bar shall be Type 21 and shall be provided for each pair of doors equipped with an overlapping astragal. The coordinator may be gravity operated and shall be capable of holding the active door of a pair open until the inactive door has preceded it in the closing cycle. When used as fire exit hardware, the coordinator and carry bar shall be listed or labeled by a nationally recognized independent testing laboratory.

##### 2.5.3 Omitted

##### 2.5.4 Omitted

##### 2.5.5 Automatic Flush Bolts

Automatic flush bolts shall be Type 25 in accordance with BHMA A156.3, and shall be installed at the top and bottom of the inactive leaf of pairs of fire rated doors where specified in the hardware sets. Flush bolts shall be mortised in the strike edge of the door.

#### 2.6 DELAYED EGRESS LOCKS

Delayed egress locking devices shall comply with BHMA A156.24. Each delayed egress lock shall have a sign that reads "PUSH UNTIL ALARM SOUNDS, DOOR CAN BE OPENED IN 15 SECONDS". Sign letters shall be 1 inch high with 1/8 inch wide stroke. The sign shall be for mounting on the door near the delayed egress lock.

#### 2.7 KEYING

Locks shall be keyed in sets or subsets as scheduled. Locks shall be furnished with the manufacturer's standard construction key system. Change keys for locks shall be stamped with change number and the inscription "U.S. Property - Do Not Duplicate." Keys shall be supplied as follows:

|                    |                          |
|--------------------|--------------------------|
| Locks:             | 3 change keys each lock. |
| Master keyed sets: | 3 keys each set.         |
| Grand master keys: | 3 total.                 |
| Control keys:      | 4 total.                 |
| Key blanks:        | 50 total.                |

The keys shall be furnished to the Contracting Officer arranged for key control system storage in sets or subsets as scheduled.

## 2.8 DOOR CLOSING DEVICES

Door closing devices shall conform to BHMA A156.4, Grade 1. Closing devices shall be products of one manufacturer for each type specified. The opening resistance of closing devices shall not exceed 15 lbf applied at the latch stile or exceed 5 lbf where low opening resistance is scheduled.

### 2.8.1 Surface Type Closers

Surface type closers shall be Grade 1, Series C02000 Standard Cover with options PT-4C, Size 1 or 2 through Size 6, and PT-4D with back check position valve. Except as otherwise specified, sizes shall conform to the manufacturer's published recommendations. Closers for outswinging exterior doors shall have parallel arms or shall be top jamb mounted. Closers for doors close to a wall shall be of narrow projection so as not to strike the wall at the 90-degree open position.

### 2.9 OMITTED

### 2.10 ELECTRO-MAGNETIC CLOSER-HOLDERS

Door closers with integral hold-open device at rated openings shall conform to BHMA A156.15 and shall release the door upon activation of the building fire alarm system or interruption of electric power. Electric power supply shall be 24 volt AC.

### 2.11 OMITTED

### 2.12 ARCHITECTURAL DOOR TRIM

Architectural door trim shall conform to BHMA A156.6.

#### 2.12.1 Door Protection Plates

##### 2.12.1.1 Omitted

##### 2.12.1.2 Kick Plates

Kick plates shall be Type J102 stainless steel. Width of plates shall be 2 inches less than door width for single doors and 1 inch less for pairs of doors. Height shall be 12 inches, except where the bottom rail is less than 12 inches the plate shall extend to within 1/2 inch of the panel mold or glass bead. Edges of metal plates shall be beveled.

### 2.13 OMITTED

### 2.14 MISCELLANEOUS

#### 2.14.1 Automatic Door Bottoms

Automatic door bottoms shall be part of the Sound Rated Door assemblies specified in Sections 08110 STEEL DOORS AND FRAMES and 08210 WOOD DOORS.

#### 2.14.2 Metal Thresholds

Thresholds shall conform to BHMA A156.21. Thresholds for exterior doors shall be extruded aluminum of the type indicated and shall provide proper clearance and an effective seal with specified weather stripping. Latching thresholds shall be of such height that the bottom of the door shall be 1/8 inch over the tread of the threshold and 1/8 inch below the top of the stop. Where required, thresholds shall be modified to receive projecting bolts or flush bolts. Thresholds for doors accessible to the handicapped shall be beveled with slopes not exceeding 1:2 and with heights not exceeding 1/2 inch. Air leakage rate of weatherstripping shall not exceed 0.5 cubic feet per minute per lineal foot of crack when tested in accordance with ASTM E 283 at standard test conditions. Thresholds at STC rated doors shall be part of the door assembly.

#### 2.14.3 Omitted

#### 2.14.4 Aluminum Housed Type Weatherseals

Weatherseals of the type indicated shall consist of extruded aluminum retainers not less than 0.07 inch wall thickness with vinyl, neoprene, silicone rubber, polyurethane or vinyl brush inserts. Aluminum shall be clear (natural) anodized. Weatherseal material shall be of an industrial/commercial grade. Seals shall remain functional through all weather and temperature conditions. Air leakage rate of weatherstripping shall not exceed 0.5 cubic feet per minute per lineal foot of crack when tested in accordance with ASTM E 283 at standard test conditions.

#### 2.14.5 Gasketing

Gasketing shall be a compression type seal, silicon based, self-adhesive product for use on steel door frames with wood and steel doors for 45 STC sound rating. Color shall be bronze. Air leakage rate of weatherstripping shall not exceed 0.5 cubic feet per minute per lineal foot of crack when tested in accordance with ASTM E 283 at standard test conditions.

#### 2.14.6 Key Control Storage System

Key control storage system shall conform to BHMA A156.5, double-tagged system, wall cabinet; capacity 75, and shall be properly labeled for key identification. Set up, identification labeling and location of the key control storage shall be as directed at the Predelivery Conference.

#### 2.14.7 Door Stops

Wall stops, floor stops and combination stop and holders shall conform to BHMA A156.16.

#### 2.15 FASTENINGS

Fastenings of proper type, size, quantity, and finish shall be supplied with each article of hardware. Machine screws and expansion shields shall be used for attaching hardware to concrete or masonry. Fastenings exposed to the weather in the finished work shall be of brass, bronze, or stainless steel. Sex bolts, through bolts, or machine screws and grommet nuts, where used on reverse-bevel exterior doors equipped with half-surface or full-surface hinges, shall employ one-way screws or other approved tamperproof screws. Screws for the jamb leaf of half-mortise and full-surface hinges attached to structural steel frames shall be one-way or other approved tamperproof type.

#### 2.16 FINISHES

Unless otherwise specified, finishes shall conform to those identified in BHMA

A156.18. Where painting of primed surfaces is required, painting is specified in Section 09900 PAINTING, GENERAL.

## 2.17 HARDWARE FOR FIRE DOORS

Hardware for fire doors shall conform to the requirements of NFPA 80 and NFPA 101.

## PART 3 EXECUTION

### 3.1 APPLICATION

Hardware shall be located in accordance with DHI Locations for CSD and DHI Locations for SSD, except that deadlocks shall be mounted 48 inches above finish floor. When approved, slight variations in locations or dimensions will be permitted. Application shall be in accordance with DHI ANSI/DHI A115.1G or DHI ANSI/DHI A115-W. Door control devices for exterior doors such as closers and holders, shall be attached to doors with thru bolts and nuts or sex bolts. Alternate fastening methods may be approved by the Contracting Officer when manufacturers' documentation is submitted to verify that the fastening devices and door reinforcements are adequate to resist wind induced stresses. Electric hardware items and access control devices shall be installed in accordance with manufacturer's printed installation procedures.

#### 3.1.1 Hardware for Fire Doors

Hardware for fire doors shall be installed in accordance with the requirements of NFPA 80. Exit devices installed on fire doors shall have a visible label bearing the marking "Fire Exit Hardware". Other hardware installed on fire doors, such as locksets, closers, and hinges shall have a visible label or stamp indicating that the hardware items have been approved by an approved testing agency for installation on fire-rated doors. Hardware for smoke-control door assemblies shall be installed in accordance with NFPA 105.

#### 3.1.2 Door-Closing Devices

Door-closing devices shall be installed and adjusted in accordance with the templates and printed instructions supplied by the manufacturer of the devices. Insofar as practicable, doors opening to or from halls and corridors shall have the closer mounted on the room side of the door.

#### 3.1.3 Key Control Storage Systems

Key control storage system shall be installed where directed.

#### 3.1.4 Kick Plates

Kick plates shall be installed on the push side of single-acting doors and on both sides of double-acting doors.

#### 3.1.5 Auxiliary Hardware

Lever extension flush bolts shall be installed at the top and bottom of the inactive leaf of pairs of doors. The bottom bolt shall operate into a dust-proof floor strike or threshold.

#### 3.1.6 Thresholds

Thresholds shall be secured with a minimum of three fasteners per single door width and six fasteners per double door width with a maximum spacing of 12 inches. Exterior thresholds shall be installed in a bed of sealant with expansion anchors and stainless steel screws, except that bronze or anodized bronze thresholds shall be installed with expansion anchors with brass screws.

Minimum screw size shall be No. 10 length, dependent on job conditions, with a minimum of 3/4 inch thread engagement into the floor or anchoring device used.

3.1.7 Omitted

3.1.8 Weatherseals

Weatherseals shall be located as indicated, snug to door face and fastened in place with color matched metal screws after door and frames have been finish painted. Screw spacing shall be as recommended by manufacturer.

3.1.9 Gasketing

Gasketing shall be installed at the inside edge of the hinge and head and latch sides of door frame. Frames shall be toleranced for a 1/8 inch clearance between door and frame. Frames shall be treated with tape primer prior to installation.

3.2 OPERATIONAL TESTS

Prior to acceptance of any electrical hardware system, an operational test shall be performed to determine if devices are operating as intended by the specifications. Wiring shall be tested for correct voltage, current carrying capacity, and proper grounding. Stray voltages in lock wiring shall be eliminated to prevent locking devices from releasing in critical situations.

3.3 FIELD QUALITY CONTROL

Architectural Hardware Consultant shall inspect the completed installation and certify that the hardware has been furnished and installed in accordance with the manufacturers' instructions and as specified. The inspection report shall identify any malfunctioning items and recommend adjustment or replacement as appropriate.

3.4 HARDWARE SETS

HW-1

|   |     |
|---|-----|
| 4 PR Hinges, A5111 4.5 x 4.5 NRP              | 630 |
| 2 EA Exit Devices A156.3 Type 2 Grade 1 x F08 | 626 |
| 2 EA Cylinders                                | 630 |
| 2 EA Closers C02000, Grade 1 x PT-4C, 4G      | 630 |
| 1 EA Threshold A156.21 as detailed            |     |
| 1 Set Weatherstripping S88                    |     |

HW-2

|   |     |
|---|-----|
| 2 PR Hinges, A5111 5 x 4.5 NRP                | 630 |
| 1 EA Exit Devices A156.3 Type 1 Grade 1 x F01 | 626 |
| 1 EA Closer C02000, Grade 1 x PT-4C, 4G       | 630 |
| 1 EA Automatic Door Bottom, *                 |     |
| 1 EA Stop L22101                              | 626 |
| 1 EA Threshold *                              |     |
| 2 Sets Sound Seals *                          |     |

\* Sound Rated Door Assembly - by assembly manufacturer.

HW-3

|  |     |
|--|-----|
| 2 PR Hinges, A5111 4.5 x 4.5 NRP             | 630 |
| 1 EA Exit Device A156.3 Type 1 Grade 1 x F08 | 630 |
| 1 EA Cylinder                                | 630 |
| 1 EA Closer C02000, Grade 1 x PT-4D          | 630 |

|   |     |
|---|-----|
| 1 EA Stop L22101  | 626 |
| 1 EA Threshold as detailed  |     |
| 1 Set Weatherstripping S88 (Head & Jambs)                         |     |
| HW-4  |     |
| 2 PR Hinges, A8133 5 x 4.5 (Doors 21, 46)                         | 626 |
| 1.5 PR Hinges A8133 5 x 4.5(Doors 3, 23, 24, 25, 29)              | 626 |
| 1 Ea Lock Set A156.13 Grade 1 x F13                               | 632 |
| 1 EA Pushbutton Mechanical Lock (21, 24, 25 only)                 | 626 |
| 1 EA Electro-mechanical Lock (Door 44 only)                       | 626 |
| 1 EA Stop L22101 (L12141 @ 29 only)                               | 626 |
| 1 EA Threshold as detailed  |     |
| 3 EA Silencers L03011   |     |
| Locksets at Doors 3 and 29 shall have lever handles               |     |
| HW-5  |     |
| 1.5 PR Hinges, A8112 5 x 4.5                                      | 626 |
| 1 Ea Lock Set A156.13 Grade 1 x F13 (Lever)                       | 626 |
| 1 EA Electro-mechanical Lock                                      | 626 |
| 1 EA Electric Strike (Control by GFGI device)                     | 626 |
| 1 EA Closer C02000,x PT-44C                                       | 630 |
| 1 EA Kick Plate   | 630 |
| 1 EA Stop L22101  | 626 |
| 1 EA Threshold as detailed  |     |
| 1 Set Weatherstripping S88  |     |
| HW-6  |     |
| 1.5 PR Hinges A8112 5 x 4.5 NRP                                   | 626 |
| 1 Ea Lock Set A156.13 Grade 1 x F13 (Lever)                       | 626 |
| 1 EA Pushbutton Mechanical Lock (21, 24, 25 only)                 | 626 |
| 1 EA Closer C02000, x PT-4D                                       | 630 |
| 1 EA Kick Plate   | 630 |
| 1 EA Automatic Door Bottom, Heavy Duty *                          |     |
| 1 EA Stop L22101  | 626 |
| 1 EA Threshold as detailed *                                      |     |
| 1 Set Sound Seals *   |     |
| * Sound Rated Door Assembly - by assembly manufacturer.           |     |
| HW-7  |     |
| 4 PR Hinges, A8112 4.5 x 4.5 NRP                                  | 626 |
| 1 Ea Lock Set A156.2 Grade 1 x F91                                | 626 |
| 1 PR Automatic Flush Bolt A156.3 Type 25                          | 626 |
| 1 EA Coordinator Type 21, Grade 1                                 | 626 |
| 2 EA Overhead Closer-Holders A156.15 Grade 1                      | 626 |
| 2 EA Stops L22101   | 626 |
| 2 EA Silencers L03011 Gray Rubber                                 |     |
| HW-8  |     |
| 2 PR Hinges, A8112 4.5 x 4.5 NRP                                  | 626 |
| 1 EA Exit Device A156.3 Type 1 Grade 1 x F08 (F01 @ Door 31)      | 626 |
| 1 EA Electro-mechanical Lock (Door 6 only) (Mated to Exit Device) | 626 |
| 1 EA Pushbutton Mechanical Lock (Door 6 only)                     | 626 |
| 1 EA Cylinder   | 630 |
| 1 EA Electric Strike as required                                  | 626 |

(Control by GFGI device)

|        |                                     |     |
|--------|-------------------------------------|-----|
| 1 EA   | Closer C02000, x PT-4D              | 630 |
| 1 EA   | Kick Plate                          | 630 |
| 1 EA   | Automatic Door Bottom, Heavy Duty * |     |
| 2 Sets | Sound Seals *                       |     |
| 1 EA   | Stop L22101                         | 626 |
| 1 EA   | Threshold as detailed *             |     |

\* Sound Rated Door Assembly - by assembly manufacturer.

HW-9

|      |   |     |
|------|---|-----|
| 2 PR | Hinges, A8112 4.5 x 4.5 NRP             | 626 |
| 1 EA | Exit Device A156.3 Type 1 Grade 1 x F08 | 626 |
| 1 EA | Cylinder                                | 630 |
| 1 EA | Closer C02000, x PT-4D                  | 630 |
| 1 EA | Stop L22101                             | 626 |
| 1 EA | Threshold as detailed                   |     |
| 3 EA | Silencers L03011                        |     |

HW-10

|      |  |     |
|------|--|-----|
| 3 PR | Hinges, A5111 4.5 x 4.5 NRP            | 626 |
| 1 Ea | Lock Set A156.13 Grade 1 x F07 (Lever) | 626 |
| 2 EA | Flush Bolts L24081                     | 630 |
| 2 EA | Closers C02000, x PT-4D                | 630 |
| 2 EA | Stops L22101                           | 626 |
| 2 EA | Silencers L03011                       |     |

HW-11

|       |                                      |     |
|-------|--------------------------------------|-----|
| 4 PR  | Hinges, A5111 4.5 x 4.5 NRP          | 630 |
| 1 Ea  | Lock Set A156.13 Grade 1 x F07       | 626 |
| 1 EA  | Pushbotton Mechanical Lock (22 only) |     |
| 2 EA  | Flush Bolts L24081                   | 630 |
| 2 EA  | Closers C02000, x PT-4C              | 630 |
| 2 EA  | Overhead holders                     | 626 |
| 1 EA  | Threshold as detailed                |     |
| 1 Set | Weatherstripping S88                 |     |

HW-12

|      |                                |     |
|------|--------------------------------|-----|
| 2 PR | Hinges, A8133 5 x 4.5          | 626 |
| 1 Ea | Lock Set A156.13 Grade 1 x F13 | 626 |
| 1 EA | Cylinder                       | 630 |
| 1 EA | Closer C02000, x PT-4D         | 630 |
| 3 EA | Silencers L03011               |     |
| 1 EA | Stops L22101                   | 626 |

HW-13

|        |  |     |
|--------|--|-----|
| 1.5 PR | Hinges, A8133 5 x 4.5                  | 626 |
| 1 Ea   | Lock Set A156.13 Grade 1 x F13 (Lever) | 626 |
| 1 EA   | Kick Plate                             | 630 |
| 1 EA   | Stop L22101 (L12141 @ 10 and 35)       | 626 |
| 1 EA   | Threshold as detailed *                |     |
| 2 Sets | Sound Seals *                          |     |
| 1 EA   | Automatic Door Bottom, Heavy Duty *    |     |

\* Sound Rated Door Assembly - by assembly manufacturer.

HW-14



2 each Key Control Cabinet Allowed to 50% with Expansion Permanent  
Loan Register.

-- End of Section --

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DIVISION 08 - DOORS & WINDOWS

SECTION 08810

GLASS AND GLAZING

05/97

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CEGS-08810 (May 1997)

Includes changes through Notice 4 (May 2000)

SECTION 08810

GLASS AND GLAZING  
**05/97**

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

|            |   |
|------------|---|
| ANSI Z97.1 | (1984; R 1994) Safety Performance Specifications and Methods of Test for Safety Glazing Materials Used in Buildings |
|------------|---|

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

|             |  |
|-------------|--|
| ASTM C 920  | (1998) Elastomeric Joint Sealants  |
| ASTM C 1036 | (1991; R 1997) Flat Glass  |
| ASTM C 1048 | (1997b) Heat-Treated Flat Glass - Kind HS, Kind FT Coated and Uncoated Glass                   |
| ASTM D 395  | (1998) Rubber Property - Compression Set   |
| ASTM E 773  | (1997) Accelerated Weathering of Sealed Insulating Glass Units                                 |
| ASTM E 774  | (1997) Classification of the Durability of Sealed Insulating Glass Units                       |
| ASTM E 1300 | (1998) Determining the Minimum Thickness and Type of Glass Required to Resist a Specified Load |

GLASS ASSOCIATION OF NORTH AMERICA (GANA)

|                       |                                     |
|-----------------------|-------------------------------------|
| GANA Glazing Manual   | (1997) Glazing Manual               |
| GANA Standards Manual | (1995) Engineering Standards Manual |

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

|          |  |
|----------|--|
| NFPA 80  | (1999) Fire Doors and Fire Windows                         |
| NFPA 252 | (1995) Fire Tests of Door Assemblies                       |
| NFPA 257 | (1996) Fire Tests for Window and Glass<br>Block Assemblies |

## 1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

### SD-02 Shop Drawings

#### Installation

Drawings showing complete details of the proposed setting methods, mullion details, edge blocking, size of openings, frame details, materials, and types and thickness of glass.

### SD-03 Product Data

#### Insulating Glass Glazing Accessories

Manufacturer's descriptive product data, handling and storage recommendations, installation instructions, and cleaning instructions.

### SD-07 Certificates

#### Insulating Glass

Certificates stating that the glass meets the specified requirements. Labels or manufacturers marking affixed to the glass will be accepted in lieu of certificates.

## 1.3 SYSTEM DESCRIPTION

Glazing systems shall be fabricated and installed watertight and airtight to withstand thermal movement and wind loading without glass breakage, gasket failure, deterioration of glazing accessories, and defects in the work. Glazed panels shall comply with the safety standards, as indicated in accordance with ANSI Z97.1. Glazed panels shall comply with indicated wind/snow loading in accordance with ASTM E 1300.

## 1.4 DELIVERY, STORAGE AND HANDLING

Glazing compounds shall be delivered to the site in the manufacturer's unopened containers. Glass shall be stored indoors in a safe, well

ventilated dry location in accordance with manufacturer's instructions, and shall not be unpacked until needed for installation. Glass shall not be stored on site over 1 month.

#### 1.5 PROJECT/SITE CONDITIONS

Glazing work shall not be started until outdoor temperature is above 40 degrees F and rising, unless procedures recommended by glass manufacturer and approved by Contracting Officer are made to warm the glass and rabbet surfaces. Ventilation shall be provided to prevent condensation of moisture on glazing work during installation. Glazing work shall not be performed during damp or raining weather.

#### 1.6 WARRANTY

##### 1.6.1 Insulating Glass

Manufacturer shall warrant the insulating glass to be free of fogging or film formation on the internal glass surfaces caused by failure of the hermetic seal for a period of 10 years from Date of Substantial Completion. Warranty shall be signed by manufacturer.

### PART 2 PRODUCTS

#### 2.1 FLOAT GLASS

##### 2.1.1 Annealed Glass

Annealed glass shall be Type I transparent flat type, Class 1 - clear for interior and tinted for exterior, Quality q3 - glazing select, matching existing, conforming to ASTM C 1036. Color shall match existing.

#### 2.2 ROLLED GLASS

##### 2.2.1 Omitted

##### 2.2.2 Wired Glass

Wired glass shall be Type II flat type, Class 1 - translucent, Quality q8 - glazing, Form 1 - wired and polished both sides, conforming to ASTM C 1036.

Wire mesh shall be polished stainless steel Mesh 2 - square. Wired glass for fire-rated windows shall bear an identifying UL label or the label of a nationally recognized testing agency, and shall be rated for 20 minutes when tested in accordance with NFPA 257. Wired glass for fire-rated doors shall be tested as part of a door assembly in accordance with NFPA 252.

#### 2.3 INSULATING GLASS

Insulating glass shall be Class A preassembled units of dual-seal construction consisting of lites of glass separated by an aluminum, steel, or stainless steel, spacer and dehydrated space conforming to ASTM E 773 and ASTM E 774. Spacer shall be roll-formed, with bent or tightly welded or keyed and sealed joints to completely seal the spacer periphery and eliminate moisture and hydrocarbon vapor transmission into airspace through

the corners. Primary seal shall be compressed polyisobutylene and the secondary seal shall be a specially formulated silicone. Glass types shall be as follows:

- 2.3.1 Omitted
- 2.3.2 Omitted
- 2.3.3 Omitted

#### 2.3.4 Low-E Insulating Glass

Interior and exterior glass panes for Low-E insulating units shall be Type I annealed flat glass, Class 2-tinted with anti-reflective low-emissivity coating on No. 2 surface (inside surface of exterior pane), Quality q3 - glazing select, conforming to ASTM C 1036. Glass performance shall be R-Value/Winter Nighttime 0.31. Color shall match existing.

#### 2.4 REFLECTIVE GLASS

Reflective glass shall conform to the following requirements.

- 2.4.1 Omitted
- 2.4.2 Low-Emissivity (Low-E) Glass

Low-emissivity (Low-E) glass shall be Type I annealed flat type, Class 2-tinted with low-emissivity coating on No. 2 surface (inside surface of exterior pane), Quality q3 - glazing select. Color shall match existing.

#### 2.5 HEAT-TREATED GLASS

Heat-treated glass shall conform to the following requirements.

##### 2.5.1 Tempered Glass

Tempered glass shall be kind FT fully tempered transparent flat type, Class 1-clear, Condition A uncoated surface, Quality q3 - glazing select, conforming to ASTM C 1048 and GANA Standards Manual. Color shall be clear.

- 2.6 OMITTED
- 2.7 OMITTED
- 2.8 OMITTED
- 2.9 OMITTED
- 2.10 OMITTED

#### 2.11 GLAZING ACCESSORIES

##### 2.11.1 Preformed Tape

Preformed tape shall be elastomeric rubber extruded into a ribbon of a width and thickness suitable for specific application. Tape shall be of type which will remain resilient, have excellent adhesion, and be chemically compatible to glass, metal, or wood.

##### 2.11.2 Sealant

Sealant shall be elastomeric conforming to ASTM C 920, Type S or M, Grade NS, Class 12.5, Use G, of type chemically compatible with setting blocks, preformed sealing tape and sealants used in manufacturing insulating glass. Color of sealant shall match existing.

2.11.3 Omitted

2.11.4 Omitted

#### 2.11.5 Setting and Edge Blocking

Neoprene setting blocks shall be dense extruded type conforming to ASTM D 395, Method B, Shore A durometer between 70 and 90. Edge blocking shall be Shore A durometer of 50 (+ or - 5). Silicone setting blocks shall be required when blocks are in contact with silicone sealant. Profiles, lengths and locations shall be as required and recommended in writing by glass manufacturer.

### PART 3 EXECUTION

#### 3.1 PREPARATION

Openings and framing systems scheduled to receive glass shall be examined for compliance with approved shop drawings, GANA Glazing Manual and glass manufacturer's recommendations including size, squareness, offsets at corners, presence and function of weep system, face and edge clearance requirements and effective sealing between joints of glass-framing members. Detrimental materials shall be removed from glazing rabbet and glass surfaces and wiped dry with solvent. Glazing surfaces shall be dry and free of frost.

#### 3.2 INSTALLATION

Glass and glazing work shall be performed in accordance with approved shop drawings, GANA Glazing Manual, glass manufacturer's instructions and warranty requirements. Glass shall be installed with factory labels intact and removed only when instructed. Wired glass and fire/safety rated glass shall be installed in accordance with NFPA 80. Edges and corners shall not be ground, nipped or cut after leaving factory. Springing, forcing or twisting of units during installation will not be permitted.

#### 3.3 CLEANING

Upon completion of project, outside surfaces of glass shall be washed clean and the inside surfaces of glass shall be washed and polished in accordance with glass manufacturer's recommendations.

#### 3.4 PROTECTION

Glass work shall be protected immediately after installation. Glazed openings shall be identified with suitable warning tapes, cloth or paper flags, attached with non-staining adhesives. Reflective glass shall be protected with a protective material to eliminate any contamination of the reflective coating. Protective material shall be placed far enough away



from the coated glass to allow air to circulate to reduce heat buildup and moisture accumulation on the glass. Glass units which are broken, chipped, cracked, abraded, or otherwise damaged during construction activities shall be removed and replaced with new units.

-- End of Section --

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DIVISION 09 - FINISHES

SECTION 09225

STUCCO

**11/95**

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CEGS-09225 (November 1995)

Includes changes through Notice 4 (January 2001)

SECTION 09225

STUCCO  
**11/95**

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

|             |   |
|-------------|---|
| ASTM A 185  | (1997) Steel Welded Wire Fabric, Plain, for Concrete Reinforcement  |
| ASTM C 150  | (1999a) Portland Cement   |
| ASTM C 206  | (1984; R 1997) Finishing Hydrated Lime  |
| ASTM C 841  | (1999) Installation of Interior Lathing and Furring   |
| ASTM C 847  | (1995) Metal Lath   |
| ASTM C 897  | (1996) Aggregate for Job-Mixed Portland Cement-Based Plasters   |
| ASTM C 926  | (1998a) Application of Portland Cement-Based Plaster  |
| ASTM C 1063 | (1999) Installation of Lathing and Furring to Receive Interior and Exterior Portland Cement-Based Plaster |
| ASTM D 1784 | (1999a) Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds  |

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office

that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-03 Product Data

Materials

Manufacturers installation instructions for stucco materials.

SD-04 Samples

Stucco Finish Coat

One 12 inch square stucco panel showing finish texture and exposed reinforcement at the edges, one 12 inch square of reinforcement, and a 12 inch length of each accessory proposed, prior to proceeding with stucco work.

1.3 DELIVERY AND STORAGE

Packaged materials shall be delivered to the site in the original packages and containers with labels intact and seals unbroken. Cementitious materials shall be kept dry and stored off the ground under cover away from damp surfaces until ready to be used. Aggregate shall be covered to prevent the absorption or loss of moisture.

1.4 ENVIRONMENTAL CONDITIONS

Stucco shall not be applied when the ambient temperature is 40 degrees F or lower, or when a drop in temperature below 40 degrees F is expected within 48 hours after application.

PART 2 PRODUCTS

2.1 PORTLAND CEMENT

Portland cement shall conform to ASTM C 150, gray portland cement Type II.

2.2 STUCCO FINISH COAT

Stucco finish coat shall be a mill mixed product using white portland cement and requiring only the addition of and mixing with water for application.

2.3 LIME

Lime shall conform to ASTM C 206, Type S.

2.4 SAND

Sand aggregate for job-mixed base coat and job-mixed finish coat stucco shall conform to ASTM C 897.

2.5 ACCESSORIES

Accessories shall be roll formed galvanized steel, or rigid polyvinyl chloride (PVC), except that cornerite and striplath shall be formed from steel sheets with manufacturer's standard galvanized coating. Vinyl members shall be in accordance with ASTM D 1784. Welded wire corner reinforcements shall be zinc coated, galvanized 17 gauge steel wire conforming to ASTM A 185. Furring shall include hangers, bolts, inserts, clips, fastenings, and attachments of number, size, and design to develop the full strength of the members.

## 2.6 STEEL FRAMING

Steel framing shall be as shown and shall be manufacturers standard products with shop applied protective coating.

## 2.7 METAL LATH

Metal lath shall conform to ASTM C 847, types and weights in accordance with the various spacing shown in ASTM C 841. 2 x 2 inches. Expanded metal lath shall be fabricated in a manner to provide not less than 1/4 inch keying between wire and paper backing and keying shall be obtained by a uniform series of slots in a perforated face paper woven between the wires.

## 2.8 WATER

Water shall be clean, fresh, potable, and free from amounts of oils, acids, alkalis and organic matter that would be injurious to the stucco.

# PART 3 EXECUTION

## 3.1 FRAMING

Framing shall be installed as indicated.

## 3.2 CONTROL JOINTS

Control joints shall be located as indicated on the drawings. Prefabricated control joint members shall be installed prior to the application of the stucco. Control joints shall be cleared of all stucco within the control area after stucco application and prior to final stucco set.

## 3.3 LATH

Lath shall be installed in accordance with ASTM C 841 or ASTM C 1063 except as otherwise specified. Metal lath shall be applied straight, without buckles and with joints staggered. End laps of metal lath shall be not less than 1 inch. When paper-backed lath is used, the paper shall be split from the lath at all lap areas to provide a paper to paper and lath to lath lap. Horizontal joints shall be shiplapped. Lath shall be interrupted at all control joints.

### 3.3.1 Steel Supports

Lath shall be secured to the wood frames with nails or staples spaced not over 6 inches on centers along each support; and where sheets of lath are lapped, fasteners shall be driven so as to hold both lapped edges securely in place. Lath shall be secured to steel frames in accordance with ASTM C 841 or ASTM C 1063, as applicable.

### 3.4 FURRING

Furring shall be installed to true lines and surfaces and shall be rigidly supported and secured in place.

### 3.5 PREPARATION OF SURFACES

Preparation of surfaces for application of stucco to solid bases such as stone, masonry or concrete shall conform to the applicable requirements of ASTM C 926.

### 3.6 PROPORTIONS AND MIXING

Proportions and mixing for job-mixed base coat and finish coat shall conform to the applicable requirements of ASTM C 926. Mixing of mill-mixed finish coat shall be in accordance with the manufacturer's directions.

### 3.7 STUCCO APPLICATION

Stucco shall be applied in three coats to a thickness of not less than 1 inch as measured from the back plane of metal reinforcement, exclusive of ribs or dimples or from the face of solid backing or support, with or without metal reinforcement, to the finished stucco surface, including moderate texture variations. Stucco application shall conform to the applicable requirements of ASTM C 926 and the following:

#### 3.7.1 Workmanship

Items or features of the work in connection with or adjoining the stucco shall be in place, plumb, straight, and true prior to beginning the stucco work. Metal and wire lath, where required, shall be in place and positioned to provide a good key at back of lath. Where lath is applied over copper, the copper shall be given a heavy coat of bituminous paint. Masonry surfaces to receive stucco shall be evenly dampened immediately prior to application of stucco. Each stucco coat shall be applied continuously in one general direction, without allowing mortar to dry at edges. Where it is impossible to work the full dimension of a wall surface in a continuous operation, jointing shall be made at a break, opening, or other natural division of the surface. Edges to be joined shall be dampened slightly to produce a smooth confluence. Exterior corners of stucco shall be slightly rounded. Stucco on soffit surfaces shall be pitched forward to form a drip.

#### 3.7.2 Scratch Coat

Scratch coat shall be applied not less than 3/8 inch thick under sufficient pressure to form good keys and to completely embed the reinforcement. Before the scratch coat has set, it shall be lightly

scratched in one direction and vertical surfaces shall be scratched in the horizontal direction only. The scratch coat shall be fog cured for a minimum of 72 hours.

#### 3.7.3 Brown Coat

The scratch coat shall be dampened evenly to obtain uniform suction before the brown coat is applied. There shall be no visible water on the surface when the brown coat is applied. The brown coat shall be applied to the scratch coat with sufficient pressure to force the stucco into the scratches and shall be brought to a plumb, true, even plane with rod or straightedge. When set sufficiently, the brown coat shall be uniformly floated with a dry float to promote densification of the coat and to provide a surface receptive to bonding of the finish coat. Brown coat shall be fog cured for a minimum of 72 hours.

#### 3.7.4 Finish Coat

Surfaces of the brown coat shall be dampened not more than 1 hour before the finish coat is to be applied to a uniform wetness with no free-standing water on the surface. The finish coat shall have a float finish matching existing stucco and shall conform to the approved sample. The finish coat shall be fog cured for a minimum of 48 hours. Care shall be taken to prevent staining.

#### 3.7.5 Surface Tolerance

When a 10 foot straightedge is placed at any location on the finished surface of the stucco, excluding rough-textured finish, the surface shall not vary more than 1/8 inch from the straightedge.

#### 3.8 CURING AND PROTECTION

Fog curing shall be accomplished by applying a fine mist of water to the stucco. Care shall be exercised during fog curing to avoid erosion damage to the stucco surfaces. A solid stream of water shall not be used. Frequency of fogging shall be not less than three times daily. When directed the Contractor shall protect the stucco from the direct rays of the sun during severe drying conditions using canvas, cloth or other approved sheet material.

#### 3.9 PATCHING AND POINTING

Loose, cracked, damaged or defective work shall be replaced or patched as directed. Patching shall match existing work in texture and color and shall be finished flush.

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GYPSUM WALLBOARD

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CEGS-09250 (June 1997)

Includes changes through Notice 7 (October 2000)

SECTION 09250

GYPSUM WALLBOARD

**06/97**

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

|                   |   |
|-------------------|---|
| ASTM A 580/A 580M | (1998) Stainless Steel Wire   |
| ASTM A 853        | (1993; R 1998) Steel Wire, Carbon, for General Use  |
| ASTM B 164        | (1998) Nickel-Copper Alloy Rod, Bar, and Wire   |
| ASTM C 36/C 36M   | (1999) Gypsum Wallboard   |
| ASTM C 475        | (1994) Joint Compound and Joint Tape for Finishing Gypsum Board                                       |
| ASTM C 557        | (1999) Adhesive for Fastening Gypsum Wallboard to Wood Framing  |
| ASTM C 645        | (2000) Nonstructural Steel Framing Members  |
| ASTM C 665        | (1998) Mineral Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing |
| ASTM C 754        | (1999a) Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products         |
| ASTM C 840        | (1999) Application and Finishing of Gypsum Board  |
| ASTM C 1002       | (1998) Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases         |

ASTM C 1047 (1999) Accessories for Gypsum Wallboard  
and Gypsum Veneer Base

GYPSUM ASSOCIATION (GA)

GA 214 (1996) Recommended Levels of Gypsum Board  
Finish

GA 216 (1996) Application and Finishing of Gypsum  
Board

GA 600 (1997) Fire Resistance Design Manual

UNDERWRITERS LABORATORIES (UL)

UL Fire Resist Dir (1999) Fire Resistance Directory (2 Vol.)

1.2 SYSTEM DESCRIPTION

1.2.1 Fire-Rated Construction

Joints of fire-rated gypsum board enclosures shall be closed and sealed in accordance with UL test requirements or GA requirements, and as required to meet pressurization requirements. Penetrations through rated partitions and ceilings shall be sealed tight in accordance with tested systems. Fire ratings shall be as indicated.

1.2.2 Sound Transmission Characteristics

For gypsum board assemblies with STC ratings, provide materials and construction identical to those tested in assembly indicated according to ASTM E 90 and classified according to ASTM E 413 by a qualified independent testing agency

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-07 Certificates

Gypsum Wallboard  
Steel Framing  
Fire-Rated Gypsum Board

Certificates stating that the steel framing and gypsum wallboard meet the specified requirements.

1.4 QUALIFICATIONS

Manufacturer shall specialize in manufacturing the types of material specified and shall have a minimum of 5 years of documented successful experience. Installer shall specialize in the type of gypsum board work required and shall have a minimum of 3 years of documented successful experience.

#### 1.5 DELIVERY, STORAGE AND HANDLING

Materials shall be delivered in original containers bearing the name of manufacturer, contents, and brand name. Materials shall be stored off the ground in a weathertight structure for protection. Gypsum boards shall be stacked flat, off floor and supported to prevent sagging and warpage. Adhesives and joint materials shall be stored in accordance with manufacturer's printed instructions. Damaged or deteriorated materials shall be removed from jobsite.

#### 1.6 ENVIRONMENTAL CONDITIONS

Environmental conditions for application and finishing of gypsum board shall be in accordance with ASTM C 840. During the application of gypsum board without adhesive, a room temperature of not less than 40 degrees F shall be maintained. During the application of gypsum board with adhesive, a room temperature of not less than 50 degrees F shall be maintained for 48 hours prior to application and continuously afterwards until completely dry. Building spaces shall be ventilated to remove water not required for drying joint treatment materials. Drafts shall be avoided during dry hot weather to prevent materials from drying too rapidly.

### PART 2 MATERIALS

#### 2.1 NON-LOADBEARING STUD WALLS

##### 2.1.1 Studs

Studs for non-loadbearing walls shall conform to ASTM C 645. Studs shall be C-shaped, roll formed steel with minimum uncoated design thickness of 0.0284 in made from G40 hot-dip galvanized coated sheet, except that thickness of studs at partitions receiving ceramic tile shall be .

##### 2.1.2 Runner Tracks

Floor and ceiling runner tracks shall conform to ASTM C 645. Tracks shall be prefabricated, U-shaped with minimum 1 inch flanges, unpunched web, thickness to match studs, made from G40 hot-dip galvanized coated sheet.

#### 2.2 OMITTED

#### 2.3 SUSPENDED CEILING FRAMING

Suspended ceiling framing system shall have the capability to support the finished ceiling, light fixtures, air diffusers, and accessories, as shown.

The suspension system shall have a maximum deflection of L/240. Carrying channels shall be formed from minimum 0.0548 in thick cold-rolled steel, 1-1/2 x 3/4 inch. Furring members shall be formed from cold-rolled steel,

7/8 x 2-9/16 inch. Carrying channels and furring members shall be made from hot-dip galvanized coated sheet.

#### 2.4 GYPSUM BOARD

Gypsum board shall have square-cut ends, tapered or beveled edges and shall be maximum possible length. Gypsum board thickness shall be as shown, but in no case less than .

##### 2.4.1 Standard Gypsum Board

Regular gypsum board shall conform to ASTM C 36/C 36M, and shall be 48 inches wide.

##### 2.4.2 Fire-Rated Gypsum Board

Fire-rated gypsum board shall conform to ASTM C 36/C 36M, and shall be Type X or Type C as required, 48 inches wide.

##### 2.4.3 Omitted

##### 2.4.4 Omitted

##### 2.4.5 Omitted

##### 2.4.6 Shaftwall Liner Panel

Shaftwall liner panel shall conform to UL listing. Liner Panel shall be specifically manufactured for cavity shaftwall system, with water-resistant paper faces, bevel edges, single lengths to fit required conditions, 3/4 inch thick, by 24 inches wide.

#### 2.5 TRIM, MOLDINGS, AND ACCESSORIES

##### 2.5.1 Taping and Embedding Compound

Taping and embedding compound shall conform to ASTM C 475. Compound shall be specifically formulated and manufactured for use in embedding tape at gypsum wallboard joints and fastener heads, and shall be compatible with tape and substrate.

##### 2.5.2 Finishing or Topping Compound

Finishing or topping compound shall conform to ASTM C 475. Compound shall be specifically formulated and manufactured for use as a finishing compound for gypsum board.

##### 2.5.3 All-Purpose Compound

All-purpose compound shall be specifically formulated and manufactured to use as a taping and finishing compound, and shall be compatible with tape and substrate.

##### 2.5.4 Joint Tape

Joint tape shall conform to ASTM C 475 and shall be as recommended by

gypsum board manufacturer.

#### 2.5.5 Trim, Control Joints, Beads, Stops and Nosings

Items used to protect edges, corners, and to provide architectural features shall be in accordance with ASTM C 1047.

#### 2.6 FASTENINGS, ADHESIVES, AND INSULATION

##### 2.6.1 Omitted

##### 2.6.2 Screws

Screws shall conform to ASTM C 1002. Screws shall be self-drilling and self-tapping steel, Type S for wood or light-gauge steel framing.

##### 2.6.3 Adhesives

Adhesives shall conform to ASTM C 557. For securing gypsum board to gypsum board, adhesive shall be as recommended by gypsum board manufacturer.

##### 2.6.4 Hangers

Suspended ceiling runner channel hangers shall be soft, annealed steel wire not less than No. 8 SWG, conforming to ASTM A 853.

##### 2.6.5 Wire and Clip Type Fastenings

Tie wire, clips, rings, and other fastenings shall be corrosion-resisting steel conforming to ASTM A 580/A 580M, composition 302, 304, or 316, Condition A, or nickel-copper alloy conforming to ASTM B 164, annealed condition except that walls, partitions, and other vertical surfaces not incorporated in ceiling construction may be erected with soft, annealed steel conforming to ASTM A 853.

###### 2.6.5.1 Tie Wire

Tie wire for constructing partitions and vertical furring, for securing metal lath to supports, and for lacing shall be not less than No. 18 SWG. Tie wire for other applications shall be not less than No. 16 SWG.

###### 2.6.5.2 Clips

Clips used in lieu of tie wire for securing the furring channels to the runner channels in ceiling construction shall be made from strip not less than 1/8 inch thick or shall be hairpin clip, formed of wire not less than 0.01620 inch nominal diameter. Other clips and rings or fastenings of similar materials shall be equivalent in holding power to that provided by tie wire for the specific application.

##### 2.6.6 Sound Attenuation Insulation

E. Sound attenuation insulation shall be batt or blanket conforming to ASTM C 665, Type I (blankets without membrane facing) produced by combining

thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.

## PART 3 EXECUTION

### 3.1 INTERIOR WALL FRAMING

Steel framing and furring members shall be installed in accordance with ASTM C 754. Unless otherwise indicated, members shall be in alignment with spacings not to exceed the maximum spacings indicated on drawings. Stud spacing in partitions receiving ceramic tile shall not exceed 16 inches. Runners shall be aligned accurately at the floor and ceiling and securely anchored.

#### 3.1.1 Wall Openings

The framing system shall provide for the installation and anchorage of the required subframes or finish frames for wall openings at doors, pass-through openings, and access panels. Partitions abutting continuous suspended ceilings shall be strengthened for rigidity at rough openings of more than 30 inches wide. Studs at openings shall be 0.0329 in minimum bare metal thickness and spot grouted at jamb anchor inserts. Double studs shall be fastened together with screws and secured to floor and overhead runners. Two studs shall be used for framing solid-core doors, doors over 36 inches wide and extra-heavy doors such as X-ray room doors.

#### 3.1.2 Wall Control Joints

Control joints for expansion and contraction in the walls shall be constructed with double studs installed 1/2 inch apart in interior walls or wall furrings where indicated on drawings. Control joint spacing shall not exceed 30 feet. Ceiling-height door frames may be used as vertical control joints. Door frames of less than ceiling height may be used as control joints only if standard control joints extend to ceiling from both corners of top of door frame. Control joints between studs shall be filled with firesafing insulation in fire rated partitions.

#### 3.1.3 Blocking

Blocking shall be provided as necessary for mounted equipment. Blocking shall be metal or wood and shall be cut to fit between framing members. Blocking shall be rigidly anchored to the framing members. Under no circumstances will accessories or other wall mounted equipment be anchored directly to gypsum wallboard.

### 3.2 SHAFT WALL FRAMING

The shaft wall system shall be installed in accordance with the system manufacturer's published instructions. Bucks, anchors, blocking and other items placed in or behind shaft wall framing shall be coordinated with electrical and mechanical work. Fireproofing materials which are damaged or removed during shaft wall construction shall be patched or replaced.

### 3.3 SUSPENDED CEILING FRAMING

Suspended ceiling system framing shall be installed in accordance with ASTM C 754.

#### 3.3.1 Hangers

Hangers shall be spaced not more than 48 inches along runner channels and 36 inches in the other direction or 42 inches in both directions unless otherwise indicated. Locations of hanger wires shall be coordinated with other work. Hangers at ends of runner channels shall be located not more than 6 inches from wall. Hanger wire shall be looped around bottom chord of open-web steel joists, or secured to structural elements with suitable fasteners. Sags or twists which develop in the suspended system shall be adjusted. Damaged or faulty parts shall be replaced.

#### 3.3.2 Main Runners

Main runner channels shall be installed in accordance with ASTM C 754. Hanger wires shall be double strand saddle-tied to runner channels and the ends of hanger wire shall be twisted three times around itself. Main runners shall be located to within 6 inches of the paralleling wall to support the ends of cross furring. Main runners shall not come in contact with abutting masonry or concrete walls. Where main runners are spliced, ends shall be overlapped 12 inches with flanges of channels interlocked, and shall be securely tied at each end of splice with wire looped twice around the channels.

#### 3.3.3 Furring Channels

Furring channels shall be spaced in accordance with ASTM C 754. Furring channels shall be secured to the runner channels and to structural supports at each crossing with tie wire, hairpin clips, or equivalent fastenings. Furring channels shall be located within 2 inches of parallel walls and beams, and shall be cut 1/2 inch short of abutting walls.

#### 3.3.4 Ceiling Openings

Support members shall be provided as required at ceiling openings for access panels, recessed light fixtures, and air supply or exhaust. Support members shall be not less than 1-1/2 inch main runner channels and vertically installed suspension wires or straps shall be located to provide at least the minimum support specified herein for furring and wallboard attachment. Intermediate structural members not a part of the structural system, shall be provided for attachment or suspension of support members.

#### 3.3.5 Light Fixtures and Air Diffusers

Light fixtures and air diffusers shall be supported directly from suspended ceiling runners. Wires shall be provided at appropriate locations to carry the weight of recessed or surface mounted light fixtures and air diffusers.

#### 3.3.6 Control Joints

Ceiling control joints for expansion and contraction shall be located where



indicated on drawings. A control joint or intermediate blocking shall be installed where ceiling framing members change direction.

#### 3.3.6.1 Interior Ceilings With Perimeter Relief

Control joints shall be installed so that linear dimensions between control joints shall not exceed 50 feet in either direction nor more than 2500 square feet.

#### 3.3.6.2 Interior Ceilings Without Perimeter Relief

Control joints shall be installed so that linear dimensions between control joints shall not exceed 30 feet in either direction nor more than 900 square feet.

### 3.4 APPLICATION OF GYPSUM BOARD

Install sound attenuation blankets before installing gypsum panels, unless blankets are readily installed after panels have been installed on one side. Gypsum board shall be installed in accordance with ASTM C 840, AG 214 and GA 216 and as specified. Paragraph 17.3.1 GENERAL of ASTM C 840 which permits usage of water resistant gypsum board as a base for adhesive application of ceramic or plastic tile on ceilings, does not apply. Edges and ends of gypsum boards shall be cut to obtain neat fitting joints. End joints of adjoining boards shall be staggered, and shall be staggered on opposite sides of wall. Boards shall be applied with moderate contact without forcing in place. Holes for pipes, fixtures or other small openings shall be cut with a tool which will provide a neat fit. Screws shall be driven so that the heads are slightly below the plane of paper face. Fracturing the paper face or damaging the core shall be avoided. Trim shall be installed at external and internal angles formed by the intersecting gypsum board surfaces with other surfaces. Corner beads shall be installed to vertical and horizontal corners in accordance with manufacturer's published instructions. Boards of maximum practical length shall be used so that an absolute minimum number of end joints occur. Gypsum board partitions in rooms with ceiling heights less than 10 feet shall have full height boards installed vertically with no end joints in the gypsum installation.

#### 3.4.1 Two-Ply Gypsum Board

Second layer of gypsum board shall be applied perpendicular to first layer with joints staggered and secured with mechanical fasteners. The use of adhesive shall be in accordance with ASTM C 840.

#### 3.4.2 STC-Rated Assemblies

Seal construction at perimeters, behind control and expansion joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C 919 and manufacturer's written recommendations for locating edge trim and closing off sound-flanking paths around or through gypsum board assemblies, including sealing partitions above acoustical ceilings.

### 3.5 TRIM, MOLDINGS, AND ACCESSORIES INSTALLATION

Trim, moldings and accessories shall be installed in accordance with GA 216.

### 3.6 GYPSUM BOARD FINISH

Gypsum board, shall be finished in accordance with ASTM C 840, GA 214 and GA 216. Plenum areas above ceilings shall be finished to Level 1 in accordance with GA 214. Walls and ceilings to receive a heavy-grade wall covering or heave textured finish before painting shall be finished to Level 3 in accordance with GA 214. Walls and ceilings without critical lighting to receive flat paints, light textures, or wall coverings shall be finished to Level 4 in accordance with GA 214. Unless otherwise specified, all gypsum board walls, partitions and ceilings shall be finished to Level 5 in accordance with GA 214.

### 3.7 OMITTED

### 3.8 FIRE-RESISTANT ASSEMBLIES

Gypsum wallboard construction for fire-rated assemblies shall be in accordance with UL Fire Resist Dir, or GA 600 for the design number indicated on drawings.

### 3.9 PATCHING

Surface defects and damage shall be corrected as required to leave gypsum board smooth, uniform in appearance, and ready to receive finish as specified.

-- End of Section --

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CEGS-09510 (August 1996)

Includes changes through Notice 4 (June 1999)

SECTION 09510

ACOUSTICAL CEILINGS

08/96

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

|             |  |
|-------------|--|
| ASTM C 635  | (1995) Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-In Panel Ceilings |
| ASTM C 636  | (1996) Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels                          |
| ASTM E 1264 | (1990) Standard Classification for Acoustical Ceiling Products   |
| ASTM E 1414 | (1991a) Standard Test for Airborne Sound Attenuation Between Rooms Sharing a Common Ceiling Plenum                     |

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-03 Product Data

Acoustical Ceiling Systems

Manufacturer's descriptive data, catalog cuts, and installation

instructions. Submittals which do not provide adequate data for the product evaluation will be rejected.

SD-04 Samples

Acoustical Units

Two samples of each type of acoustical unit and each type of suspension grid tee section showing texture, finish, and color.

SD-07 Certificates

Acoustical Units

Certificate attesting that the mineral based acoustical units furnished for the project contains recycled material and showing an estimated percent of such material.

1.3 GENERAL REQUIREMENTS

Acoustical treatment shall consist of sound controlling units mechanically mounted on a ceiling suspension system. The unit size, texture, finish, and color shall be as specified. . The location and extent of acoustical treatment shall be as shown on the approved detail drawings. Reclamation of mineral fiber acoustical ceiling panels to be removed from the job site shall be in accordance with paragraph RECLAMATION PROCEDURES.

1.4 DELIVERY AND STORAGE

Materials shall be delivered to the site in the manufacturer's original unopened containers with brand name and type clearly marked. Materials shall be carefully handled and stored in dry, watertight enclosures. Immediately before installation, acoustical units shall be stored for not less than 24 hours at the same temperature and relative humidity as the space where they will be installed in order to assure proper temperature and moisture acclimation.

1.5 ENVIRONMENTAL REQUIREMENTS

A uniform temperature of not less than 60 degrees F nor more than 85 degrees F and a relative humidity of not more than 70 percent shall be maintained before, during, and after installation of acoustical units.

1.6 SCHEDULING

Interior finish work such as plastering, concrete and terrazzo work shall be complete and dry before installation. Mechanical, electrical, and other work above the ceiling line shall be completed and heating, ventilating, and air conditioning systems shall be installed and operating in order to maintain temperature and humidity requirements.

1.7 WARRANTY

Manufacturer's standard performance guarantees or warranties that extend

beyond a one year period shall be provided. Standard performance guarantee or warranty shall contain an agreement to repair or replace acoustical panels that fail within the warranty period. Failures include, but are not limited to, sagging and warping of panels; rusting and manufacturers defects of grid system.

## PART 2 PRODUCTS

### 2.1 ACOUSTICAL UNITS

Acoustical units shall conform to ASTM E 1264, Class A, and the following requirements:

#### 2.1.1 Units for Exposed-Grid System ATC-1 (New)

Type: III (mineral fiber with painted finish. Type III acoustical units shall have a minimum recycled material content of 18 percent.

Minimum NRC: 0.70 when tested on mounting No. E-400

Pattern: EI.

Nominal size: 24 by 24 inches by 3/4 inch thick.

Edge detail: Recessed, vertical cut, sized for 9/16 inch grid width.

Finish: Factory-applied standard finish.

Minimum LR coefficient: 0.75.

Minimum CAC: 40.

Sag Resistance: Non-sag at 90 deg F and 0.90 RH.

#### 2.1.2 Units for Exposed-Grid System ATC-2

Match existing 24 by 48 inch system.

### 2.2 SUSPENSION SYSTEM

Suspension system shall be standard exposed-grid standard width flange and shall conform to ASTM C 635 for intermediate-duty systems. Surfaces exposed to view shall be aluminum with a factory-applied white baked-enamel finish. Wall molding shall have a flange of not less than 9/16 inch at ATC-1 and match existing 15/16 for ATC-2. Mitered corners shall be provided. Suspended ceiling framing system shall have the capability to support the finished ceiling, light fixtures, air diffusers, and accessories, as shown. The suspension system shall have a maximum deflection of 1/360 of span length.

### 2.3 HANGERS

Hangers shall be galvanized steel wire. Hangers and attachment shall support a minimum 300 pound ultimate vertical load without failure of

supporting material or attachment.

2.4 OMITTED

2.5 OMITTED

2.6 FINISHES

Acoustical units and suspension system members shall have manufacturer's standard textures, patterns and finishes as specified. Ceiling suspension system components shall be treated to inhibit corrosion.

2.7 OMITTED

2.8 CEILING ATTENUATION CLASS AND TEST

Ceiling attenuation class (CAC) range of acoustical units, when required, shall be determined in accordance with ASTM E 1414. Test ceiling shall be continuous at the partition and shall be assembled in the suspension system in the same manner that the ceiling will be installed on the project. System shall be tested with all acoustical units installed.

### PART 3 EXECUTION

#### 3.1 INSTALLATION

Acoustical work shall be provided complete with necessary fastenings, clips, and other accessories required for a complete installation. Mechanical fastenings shall not be exposed in the finished work. Hangers shall be laid out for each individual room or space. Hangers shall be placed to support framing around beams, ducts, columns, grilles, and other penetrations through ceilings. Main runners and carrying channels shall be kept clear of abutting walls and partitions. At least two main runners shall be provided for each ceiling span. Wherever required to bypass an object with the hanger wires, a subsuspension system shall be installed, so that all hanger wires will be plumb.

##### 3.1.1 Suspension System

Suspension system shall be installed in accordance with ASTM C 636 and as specified herein. There shall be no hanger wires or other loads suspended from underside of steel decking.

##### 3.1.1.1 Plumb Hangers

Hangers shall be plumb and shall not press against insulation covering ducts and pipes.

##### 3.1.1.2 Splayed Hangers

Where hangers must be splayed (sloped or slanted) around obstructions, the resulting horizontal force shall be offset by bracing, countersplaying, or other acceptable means.

##### 3.1.2 Wall Molding

Wall molding shall be provided where ceilings abut vertical surfaces. Wall molding shall be secured not more than 3 inches from ends of each length and not more than 16 inches on centers between end fastenings. Wall molding springs shall be provided at each acoustical unit in semi-exposed or concealed systems.

#### 3.1.3 Acoustical Units

Acoustical units shall be installed in accordance with the approved installation instructions of the manufacturer. Edges of acoustical units shall be in close contact with metal supports, with each other, and in true alignment. Acoustical units shall be arranged so that units less than one-half width are minimized. Units in exposed-grid system shall be held in place with manufacturer's standard hold-down clips, if units weigh less than 1 psf or if required for fire resistance rating.

#### 3.2 OMITTED

#### 3.3 CLEANING

Following installation, dirty or discolored surfaces of acoustical units shall be cleaned and left free from defects. Units that are damaged or improperly installed shall be removed and new units provided as directed.

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**07/96**

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CEGS-09650 (July 1996)

Includes changes through Notice 4 (June 1998)

SECTION 09650

RESILIENT FLOORING  
07/96

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

|             |   |
|-------------|---|
| ASTM D 4078 | (1992; R 1996) Water Emulsion Floor Polish  |
| ASTM E 648  | (1997) Critical Radiant Flux of<br>Floor-Covering Systems Using a Radiant<br>Heat Energy Source |
| ASTM E 662  | (1995) Specific Optical Density of Smoke<br>Generated by Solid Materials                        |
| ASTM F 1066 | (1995a) Vinyl Composition Floor Tile  |

1.2 FIRE RESISTANCE REQUIREMENTS

Flooring in corridors and exits shall have a minimum average critical radiant flux of 0.22 watts per square centimeter when tested in accordance with ASTM E 648. The smoke density rating shall be less than 450 when tested in accordance with ASTM E 662.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-03 Product Data

Resilient Flooring and Accessories

Manufacturer's descriptive data and installation instructions including cleaning and maintenance instructions.

SD-04 Samples

Flooring

Three samples of each indicated color and type of flooring and base. Sample size shall be minimum 2-1/2 x 4 inches.

SD-06 Test Reports

Moisture Test

Copies of test reports showing that representative product samples of the flooring proposed for use have been tested by an independent testing laboratory within the past three years or when formulation change occurred and conforms to the requirements specified.

1.4 DELIVERY AND STORAGE

Materials shall be delivered to the building site in original unopened containers bearing the manufacturer's name, project identification, and handling instructions. Materials shall be stored in a clean dry area with temperature maintained above 70 degrees F for 2 days prior to installation, and shall be stacked according to manufacturer's recommendations. Materials shall be protected from the direct flow of heat from hot-air registers, radiators and other heating fixtures and appliances.

1.5 ENVIRONMENTAL REQUIREMENTS

Areas to receive resilient flooring shall be maintained at a temperature above 70 degrees F and below 100 degrees F for 2 days before application, during application and 2 days after application. A minimum temperature of 55 degrees F shall be maintained thereafter.

1.6 SCHEDULING

Resilient flooring application shall be scheduled after the completion of other work which would damage the finished surface of the flooring.

1.7 WARRANTY

Manufacturer's standard performance guarantees or warranties that extend beyond a one year period shall be provided.

PART 2 PRODUCTS

2.1 VINYL-COMPOSITION TILE

Vinyl-composition tile shall conform to ASTM F 1066, Class 2, (through pattern tile), Composition 1, asbestos-free, and shall be 12 inches square and 1/8 inch thick. Tile shall have the color and pattern uniformly

distributed throughout the thickness of the tile. Flooring in any one continuous area shall be from the same lot and shall have the same shade and pattern.

2.2 OMITTED

2.3 OMITTED

2.4 OMITTED

2.5 OMITTED

2.6 RESILIENT BASE

Base shall be manufacturers standard rubber, coved style. Base shall be 4 inches high and a minimum 1/8 inch thick. Preformed outside corners shall be furnished.

2.7 OMITTED

2.8 OMITTED

2.9 TRANSITION STRIP

A vinyl or rubber transition strip tapered to meet abutting material shall be provided.

2.10 ADHESIVE

Adhesive for flooring and wall base shall be as recommended by the flooring manufacturer.

2.11 POLISH

Polish shall conform to ASTM D 4078.

2.12 CAULKING AND SEALANTS

Caulking and sealants shall be in accordance with Section 07900 JOINT SEALING.

2.13 MANUFACTURER'S COLOR AND TEXTURE

Color and texture shall be as indicated.

### PART 3 EXECUTION

3.1 EXAMINATION/VERIFICATION OF CONDITIONS

The Contractor shall examine and verify that site conditions are in agreement with the design package and shall report all conditions that will prevent a proper installation. The Contractor shall not take any corrective action without written permission from the Government.

3.2 SURFACE PREPARATION

Flooring shall be in a smooth, true, level plane, except where indicated as sloped. Before any work under this section is begun, all defects such as

rough or scaling concrete, low spots, high spots, and uneven surfaces shall have been corrected, and all damaged portions of concrete slabs shall have been repaired as recommended by the flooring manufacturer. Concrete curing compounds, other than the type that does not adversely affect adhesion, shall be entirely removed from the slabs. Paint, varnish, oils, release agents, sealers, waxers, and adhesives shall be removed, as recommended by the flooring manufacturer.

### 3.3 MOISTURE TEST

The suitability of the concrete subfloor for receiving the resilient flooring with regard to moisture content shall be determined by a moisture test as recommended by the flooring manufacturer.

### 3.4 INSTALLATION OF VINYL-COMPOSITION TILE

Tile flooring shall be installed with adhesive in accordance with the manufacturer's installation instructions. Tile lines and joints shall be kept square, symmetrical, tight, and even. Edge width shall vary as necessary to maintain full-size tiles in the field, but no edge tile shall be less than one-half the field tile size, except where irregular shaped rooms make it impossible. Flooring shall be cut to, and fitted around, all permanent fixtures, built-in furniture and cabinets, pipes, and outlets. Edge tile shall be cut, fitted, and scribed to walls and partitions after field flooring has been applied.

### 3.5 OMITTED

### 3.6 OMITTED

### 3.7 OMITTED

### 3.8 INSTALLATION OF RESILIENT BASE

Wall base shall be installed with adhesive in accordance with the manufacturer's written instructions. Base joints shall be tight and base shall be even with adjacent resilient flooring. Voids along the top edge of base at masonry walls shall be filled with caulk.

### 3.9 OMITTED

### 3.10 OMITTED

### 3.11 CLEANING

Immediately upon completion of installation of tile in a room or an area, flooring and adjacent surfaces shall be cleaned to remove all surplus adhesive. After installation, flooring shall be washed with a cleaning solution, rinsed thoroughly with clear cold water, and, except for raised pattern rubber flooring, rubber tile and sheet rubber flooring, rubber stair treads, and static control vinyl tile, given two coats of polish in accordance with manufacturers written instructions. After each polish coat, floors shall be buffed to an even luster with an electric polishing machine. Raised pattern rubber flooring, rubber tile and sheet rubber flooring, rubber stair treads, and static control vinyl tile shall be cleaned and maintained as recommended by the manufacturer.

3.12 PROTECTION

From the time of laying until acceptance, flooring shall be protected from damage as recommended by the flooring manufacturer. Flooring which becomes damaged, loose, broken, or curled shall be removed and replaced.

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CARPET

**10/00**

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CEGS-09680 (October 2000)

SECTION 09680

CARPET  
**10/00**

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN ASSOCIATION OF TEXTILE CHEMISTS AND COLORISTS (AATCC)

|              |  |
|--------------|--|
| AATCC TM 16  | (1998) Test Method: Colorfastness to Light                                       |
| AATCC TM 134 | (1996) Test Method: Electrostatic Propensity of Carpets                          |
| AATCC TM 165 | (1999) Test Method: Colorfastness to Crocking: Carpets - AATCC Crockmeter Method |

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

|             |   |
|-------------|---|
| ASTM D 418  | (1993; R 1997) Pile Yarn Floor Covering Construction                                      |
| ASTM D 1423 | (1999) Twist in Yarns by the Direct-Counting Method                                       |
| ASTM D 3278 | (1996e1) Test Methods for Flash Point of Liquids by Small Scale Closed-Cup Apparatus      |
| ASTM D 5252 | (1998a) Standard Practice for the Operation of the Hexapod Drum Tester                    |
| ASTM D 5417 | (1999) Standard Practice for Operation of the Vettermann Drum Tester                      |
| ASTM E 648  | (1999) Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source |

CARPET AND RUG INSTITUTE (CRI)

|         |  |
|---------|--|
| CRI 104 | (1996) Commercial Carpet Installation Standard |
|---------|--|



CODE OF FEDERAL REGULATIONS (CFR)

|             |  |
|-------------|--|
| 16 CFR 1630 | Standard for the Surface Flammability of<br>Carpet and Rugs (FF 1-70)    |
| 40 CFR 247  | Guidelines for Procurement of Products<br>that contain Recycled Material |

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Installation

Three copies of drawings indicating areas receiving carpet, carpet types, textures and patterns, direction of pile, location of seams, and locations of edge molding.

SD-03 Product Data

Carpet

Manufacturer's catalog data and printed documentation stating physical characteristics, durability, resistance to fading, and flame resistance characteristics for each type of carpet material and installation accessory.

Surface Preparation  
Installation

Three copies of the manufacturer's printed installation instructions for the carpet, including preparation of substrate, seaming techniques, and recommended adhesives and tapes.

Regulatory Requirements

Three copies of report stating that carpet contains recycled materials and/or involvement in a recycling or reuse program. Report shall include percentage of recycled material.

SD-04 Samples

Carpet  
Molding

a. Carpet: Two "Production Quality" samples 18 x 18 inches of each carpet proposed for use, showing quality, pattern, and color

specified.

b. Special Treatment Materials: Two samples showing system and installation method.

#### SD-06 Test Reports

##### Moisture and Alkalinity Tests

Three copies of test reports of moisture and alkalinity content of concrete slab stating date of test, person conducting the test, and the area tested.

#### SD-07 Certificates

##### Carpet

Certificates of compliance from a laboratory accredited by the National Laboratory Accreditation Program of the National Institute of Standards and Technology attesting that each type of carpet and carpet with cushion material conforms to the standards specified.

#### SD-10 Operation and Maintenance Data

##### Carpet

##### Cleaning and Protection

Three copies of carpet manufacturer's maintenance instructions describing recommended type of cleaning equipment and material, spotting and cleaning methods, and cleaning cycles.

### 1.3 REGULATORY REQUIREMENTS

Carpet and adhesives shall bear the Carpet and Rug Institute (CRI) Indoor Air Quality (IAQ) label or demonstrate compliance with testing criteria and frequencies through independent laboratory test results. Carpet type bearing the label will indicate that the carpet has been tested and meets the criteria of the CRI IAQ Carpet Testing Program, and minimizes the impact on indoor air quality. Contractor shall procure carpet in accordance with 40 CFR 247, shall submit a report stating that the carpet contains recycled materials and indicating the actual percentage of recycled material. Contractor shall, as much as possible, select material manufacturers that reduce pollutant and waste, recycle waste, reuse resources and scrap, and reclaim flooring materials instead of disposing into a landfill. Where possible, product shall be purchased locally to reduce emissions of fossil fuels from transporting.

### 1.4 DELIVERY AND STORAGE

Materials shall be delivered to the site in the manufacturer's original wrappings and packages clearly labeled with the manufacturer's name, brand name, size, dye lot number, and related information. Materials shall be stored in a clean, dry, well ventilated area, protected from damage and

soiling, and shall be maintained at a temperature above 60 degrees F for 2 days prior to installation.

#### 1.5 ENVIRONMENTAL REQUIREMENTS

Areas in which carpeting is to be installed shall be maintained at a temperature above 60 degrees F for 2 days before installation, during installation, and for 2 days after installation. A minimum temperature of 55 degrees F shall be maintained thereafter for the duration of the contract. Traffic or movement of furniture or equipment in carpeted area shall not be permitted for 24 hours after installation. Other work which would damage the carpet shall be completed prior to installation of carpet.

#### 1.6 WARRANTY

Manufacturer's standard performance guarantees or warranties including minimum ten (10) year wear warranty, two (2) year material and workmanship and ten (10) year tuft bind and delamination.

### PART 2 PRODUCTS

#### 2.1 CARPET

Carpet shall be first quality; free of visual blemishes, streaks, poorly dyed areas, fuzzing of pile yarn, spots or stains, and other physical and manufacturing defects. Carpet materials and treatments shall be reasonably nonallergenic and free of other recognized health hazards. All grade carpets shall have a static control construction which gives adequate durability and performance.

##### 2.1.1 Physical Characteristics, Type C-1

Carpet shall comply with the following:

- a. Carpet Construction: Tufted.
- b. Type: Broadloom 12 feet minimum usable carpet width.
- c. Pile Type: Textured loop.
- d. Pile Fiber: Commercial 100% branded (federally registered trademark) nylon continuous filament.
- e. Pile or Wire Height: Range, 0.187 inch (max) and 0.093 inch (min) in accordance with ASTM D 418.
- f. Yarn Ply: Minimum 3 in accordance with ASTM D 1423.
- g. Finished Pile Yarn Weight: 28 oz/sy. This does not include weight of backings. Weight shall be determined in accordance with ASTM D 418.
- h. Gauge: 1/10.

- i. Stitches per Inch: 12.0.
- j. Weight Density: 192,000
- k. Dye Method: Solution dyed.
- l. Backing Materials: Primary backing material shall be woven polypropylene. Secondary backing shall be "ActionLock".

2.1.2 Types C-2 and C-4

Carpet shall comply with the following:

- a. Carpet Construction: Tufted.
- b. Type: Broadloom 12 feet minimum usable carpet width.
- c. Pile Type: Cut pile.
- d. Pile Fiber: Commercial 100% branded (federally registered trademark) nylon continuous filament.
- e. Pile or Wire Height: 0.211 inch finished, 0.281 inch tufted height in accordance with ASTM D 418.
- f. Yarn Ply: Minimum 2, with 5.4 turns per inch ply twist.
- g. Finished Pile Yarn Weight: 30 oz/sy. This does not include weight of backings. Weight shall be determined in accordance with ASTM D 418.
- h. Gauge: 1/10.
- i. Stitches per Inch: 9.0.
- j. Weight Density: 153,540
- k. Dye Method: Piece dyed.
- l. Backing Materials: Primary and secondary backing material shall be woven polypropylene.

2.1.3 Types C-3 and C-5

Carpet shall comply with the following:

- a. Carpet Construction: Tufted.
- b. Type: Broadloom 12 feet minimum usable carpet width.
- c. Pile Type: Textured loop.
- d. Pile Fiber: Commercial 100% branded (federally registered trademark) nylon continuous filament.

- e. Pile or Wire Height: Average height 0.136 inch in accordance with ASTM D 418.
- f. Yarn Ply: Minimum 2 in accordance with ASTM D 1423.
- g. Finished Pile Yarn Weight: 26 oz/sy. This does not include weight of backings. Weight shall be determined in accordance with ASTM D 418.
- h. Gauge: 1/8.
- i. Stitches per Inch: 8.3.
- j. Dye Method: Yarn dyed.
- k. Backing Materials: Primary and secondary backing material shall be woven polypropylene, with hot melt thermoplastic bonding agent for secondary.

#### 2.1.4 Performance Requirements

- a. ARR (Appearance Retention Rating): Carpet shall be tested and have the minimum 3.5-4.0 (Severe) ARR when tested in accordance with either the ASTM D 5252 (Hexapod) or ASTM D 5417 (Vettermann) test methods using the number of cycles for short and long term tests as specified.
- b. Static Control: Static control shall be provided to permanently control static buildup to less than 3.5 kV when tested at 20 percent relative humidity and 70 degrees F in accordance with AATCC TM 134.
- c. Flammability and Critical Radiant Flux Requirements: Carpet shall comply with 16 CFR 1630. Carpet in corridors and exits shall have a minimum average critical radiant flux of 0.22 watts per square centimeter when tested in accordance with ASTM E 648.
- d. Tuft Bind: Tuft bind force required to pull a tuft or loop free from carpet backing shall be a minimum 10 pound average force for loop pile and 3 pound average force for cut pile.
- e. Colorfastness to Crocking: Dry and wet crocking shall comply with AATCC TM 165 and shall have a Class 4 minimum rating on the AATCC Color Transference Chart for all colors.
- f. Colorfastness to Light: Colorfastness to light shall comply with AATCC TM 16, Test Option E "Water-Cooled Xenon-Arc Lamp, Continuous Light" and shall have a minimum 4 grey scale rating after 40 hours.
- g. Delamination Strength: Delamination strength for tufted

carpet with a secondary back shall be minimum of 2.5 lbs./inch.

## 2.2 ADHESIVES AND CONCRETE PRIMER

Adhesives and concrete primers for installation of carpet shall be waterproof, nonflammable, meet local air-quality standards, and shall be as required by the carpet manufacturer. Seam adhesive shall be waterproof, nonflammable, and nonstaining as recommended by the carpet manufacturer. Release adhesive for modular tile carpet shall be as recommended by the carpet manufacturer. Adhesives flashpoint shall be minimum 140 degrees F in accordance with ASTM D 3278.

## 2.3 OMITTED

## 2.4 TAPE

Tape for seams shall be as recommended by the carpet manufacturer for the type of seam used in installation.

## 2.5 COLOR, TEXTURE, AND PATTERN

Color, texture, and pattern shall be as shown on contract drawings.

# PART 3 EXECUTION

## 3.1 SURFACE PREPARATION

Carpet shall not be installed on surfaces that are unsuitable and will prevent a proper installation. Holes, cracks, depressions, or rough areas shall be repaired using material recommended by the carpet or adhesive manufacturer. Floor shall be free of any foreign materials and swept broom clean. Before beginning work, subfloor shall be tested with glue and carpet to determine "open time" and bond.

## 3.2 MOISTURE AND ALKALINITY TESTS

Concrete slab shall be tested for moisture content and excessive alkalinity in accordance with CRI 104.

## 3.3 PREPARATION OF CONCRETE SUBFLOOR

Installation of the carpeting shall not commence until concrete substrate is at least 90 days old. The concrete surfaces shall be prepared in accordance with instructions of the carpet manufacturer. Type of concrete sealer, when required, shall be compatible with the carpet.

## 3.4 INSTALLATION

Installation shall be in accordance with the manufacturer's instructions and CRI 104. Edges of carpet meeting hard surface flooring shall be protected with molding. Installation shall be in accordance with the molding manufacturer's instructions.

### 3.4.1 Broadloom Installation

Broadloom carpet shall be installed direct glue down and shall be smooth, uniform, and secure, with a minimum of seams. Seams shall be uniform, unnoticeable, and treated with a seam adhesive. Side seams shall be run toward the light where practical and where such layout does not increase the number of seams. Breadths shall be installed parallel, with carpet pile in the same direction. Patterns shall be accurately matched. Cutouts, as at door jambs, columns and ducts shall be neatly cut and fitted securely. Seams at doorways shall be located parallel to and centered directly under doors. Seams shall not be made perpendicular to doors or at pivot points. Seams at changes in directions of corridors shall follow the wall line parallel to the carpet direction. Corridors with widths less than 6 feet shall have the carpet laid lengthwise down the corridors.

### 3.5 CLEANING AND PROTECTION

#### 3.5.1 Cleaning

After installation of the carpet, debris, scraps, and other foreign matter shall be removed. Soiled spots and adhesive shall be removed from the face of the carpet with appropriate spot remover. Protruding face yarn shall be cut off and removed. Carpet shall be vacuumed clean.

#### 3.5.2 Protection

The installed carpet shall be protected from soiling and damage with heavy, reinforced, nonstaining kraft paper, plywood, or hardboard sheets. Edges of kraft paper protection shall be lapped and secured to provide a continuous cover. Traffic shall be restricted for at least 45 hours. Protective covering shall be removed when directed by the Contracting Officer.

### 3.6 REMNANTS

Remnants remaining from the installation, consisting of scrap pieces more than 2 feet in dimension with more than 6 square feet total, shall be provided. Non-retained scraps shall be removed from site and recycled appropriately.

-- End of Section --

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SECTION 09720

WALLCOVERINGS

**01/98**

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CEGS-09720 (January 1998)

SECTION 09720

WALLCOVERINGS

01/98

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM E 84 (1996a) Surface Burning Characteristics of Building Materials

ASTM F 793 (1993) Standard Classification of Wallcovering by Durability Characteristics

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-03 Product Data

Wallcoverings  
Manufacturer's Instructions

Manufacturer's descriptive data, documentation stating physical characteristics, flame resistance, mildew and germicidal characteristics.

Installation

Preprinted installation instructions for wallcovering and accessories.

Maintenance  
Clean-Up

Preprinted cleaning and maintenance instructions for wallcovering and accessories.

SD-04 Samples

Wallcoverings

Three samples of each indicated type, pattern, and color of wallcovering. Samples of wall covering shall be minimum 5 x 7 inches and of sufficient size to show pattern repeat.

SD-07 Certificates

Wallcoverings

Manufacturer's statement attesting that the product furnished meets or exceeds specification requirements. The statement must; be dated after the award of the contract, state Contractor's name and address, name the project and location, and list the requirements being certified.

1.3 DELIVERY AND STORAGE

Materials shall be delivered to the site in manufacturers original unopened containers labeled with manufacturers name, pattern, texture, size and related information. Materials shall be stored in accordance with the manufacturer's instructions in a clean dry ventilated area with temperature maintained above 60 degrees F for two days prior to installation.

1.4 ENVIRONMENTAL REQUIREMENTS

Areas to receive wallcovering shall be maintained at a temperature above 60 degrees F for 7 days before, during, and 7 days after application.

1.5 WARRANTY

Manufacturer's standard performance guarantees or warranties that extend beyond a one-year period shall be provided.

PART 2 PRODUCTS

2.1 WALLCOVERINGS

Wallcoverings shall be material designed specifically for the specified use. The wallcovering shall contain a non-mercury based mildewcide. The wallcovering shall be type made without the use of cadmium based stabilizers. Wallcovering shall have a Class A flame spread rating of 0-25 and smoke development rating of 0-50 when tested in accordance with ASTM E 84.

2.1.1 Vinyl Wallcovering Type W-1, 2 and 3

Vinyl wallcovering shall be a vinyl coated woven or nonwoven fabric with germicidal additives and shall conform to ASTM F 793, Category V Type II, ( 13.1 to 24 ounces) total weight per square yard and width of 750 inches.

2.2 OMITTED

2.3 OMITTED

2.4 OMITTED

2.5 PRIMER AND ADHESIVE

Primer and adhesive shall be of a type recommended by the wallcovering manufacturer and shall contain a non-mercury based mildewcide. Adhesive shall be strippable type. Adhesive to install cap shall be of a type recommended by the manufacturer of the wainscot cap.

2.6 COLOR, TEXTURE, AND PATTERN

Color, texture, and pattern shall be as shown on the contract drawings.

### PART 3 EXECUTION

3.1 EXAMINATION

Contractor shall inspect all areas and conditions under which wallcoverings are to be installed. Contractor shall notify in writing of any conditions detrimental to the proper and timely completion of the installation. Work will proceed only when conditions have been corrected and accepted by the installer.

3.2 SURFACE PREPARATION

Wallcovering shall not be applied to surfaces that are rough, that contain stains that will bleed through the wallcovering, or that are otherwise unsuitable for proper installation. Cracks and holes shall be filled and rough spots shall be sanded smooth. Surfaces to receive wallcovering shall be thoroughly dry. Surface of gypsum board shall be primed as required by manufacturer's instructions to permit ultimate removal of wallcovering from the wall surface. Primer shall be allowed to completely dry before adhesive application.

3.3 INSTALLATION

3.3.1 Omitted

3.3.2 Vinyl Wallcovering

Wallcovering shall be installed in accordance with the manufacturer's installation instructions. Glue and adhesive spillage shall be immediately removed from wallcovering face and seams with a remover recommended by the manufacturer.

3.4 CLEAN-UP

Upon completion of the work, wallcovering shall be left clean and free of dirt or soiling. Surplus materials, rubbish, and debris resulting from the wallcovering installation shall be removed and area shall be left clean.

-- End of Section --

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**07/92**

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CEGS-09900 (July 1992)

Includes changes through Notice 9 (February 2000)

SECTION 09900A

PAINTING, GENERAL

07/92

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN CONFERENCE OF GOVERNMENTAL INDUSTRIAL HYGIENISTS (ACGIH)

|                    |   |
|--------------------|---|
| ACGIH Limit Values | (1996) Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices |
|--------------------|---|

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

|             |  |
|-------------|--|
| ASTM D 4258 | (1999) Surface Cleaning Concrete for Coating |
|-------------|--|

COMMERCIAL ITEM DESCRIPTIONS (CID)

|              |  |
|--------------|--|
| CID A-A-1500 | (Rev A; Notice 1) Sealer, Surface (Latex Block Filler)                   |
| CID A-A-2246 | (Rev B) Paint, Latex   |
| CID A-A-2247 | (Basic) Paint, Latex (Semigloss, Interior)                               |
| CID A-A-2336 | (Rev A) Primer Coating (Alkyd, Exterior Wood, White and Tints)           |
| CID A-A-2339 | (Basic) Stain (Wood, Solvent-Dye Type)                                   |
| CID A-A-2542 | (Basic) Sealer, Terrazzo and Concrete Floors, Waterbased                 |
| CID A-A-2834 | (Basic) Urethane, Waterborne (Low VOC, Clear)                            |
| CID A-A-2867 | (Basic) Coating, Polyurethane, Single Component Moisture Cure, Alipathic |

CID A-A-2994 (Basic) Primer Coating, Interior, for  
Walls and Wood

FEDERAL SPECIFICATIONS (FS)

FS TT-C-555 (Rev B; Am 1) Coating, Textured (for  
Interior and Exterior Masonry Surfaces)

FS TT-E-2784 (Rev A) Enamel (Acrylic-Emulsion, Exterior  
Gloss and Semigloss) (Metric)

STEEL STRUCTURES PAINTING COUNCIL (SSPC)

SSPC Paint 23 (1982) Latex Primer for Steel surfaces

SSPC SP 1 (1982) Solvent Cleaning

SSPC SP 2 (1995) Hand Tool Cleaning

SSPC SP 3 (1995) Power Tool Cleaning

SSPC SP 7/NACE 4 (1994) Brush-Off Blast Cleaning

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-03 Product Data

Paint.

The names, quantity represented, and intended use for the proprietary brands of materials proposed to be substituted for the specified materials when the required quantity of a particular batch is 50 gallons or less.

Mixing and Thinning. Application.

Manufacturer's current printed product description, material safety data sheets (MSDS) and technical data sheets for each coating system. Detailed mixing, thinning and application instructions, minimum and maximum application temperature, and curing and drying times between coats for epoxy, moisture-curing polyurethane, and liquid glaze coatings. Detailed application instructions for textured coatings shall be provided.

SD-04 Samples

Moisture-Curing Polyurethane.

A complete moisture-curing polyurethane system applied to a panel of the

same material as that on which the coating will be applied in the work and for each color specified. The sample panels will be used for quality control in applying the system.

Paint.

While the material is at the site or source of supply, and at a time agreeable to the Contractor and the Contracting Officer, a 1 quart sample of each color and batch, except for quantities of 50 gallons or less, shall be taken by random selection from the sealed containers by the Contractor in the presence of a representative of the Contracting Officer. The contents of the containers to be sampled shall be thoroughly mixed to ensure that the sample is representative. Samples shall be identified by designated name, specification number, manufacturer name and address, batch number, project contract number, intended use, and quantity involved.

#### SD-06 Test Reports

Paint.

A statement as to the quantity represented and the intended use, plus the following test report for batches in excess of 50 gallons:

- a. A test report showing that the proposed batch to be used meets specified requirements:
- b. A test report showing that a previous batch of the same formulation as the batch to be used met specified requirements, plus, on the proposed batch to be used, a report of test results for properties of weight per gallon, viscosity, fineness of grind, drying time, color, and gloss.

#### SD-07 Certificates

Lead. Mildewcide and Insecticide.

Certificate stating that paints for interior use contain no mercurial mildewcide or insecticide. Certificate stating that paints proposed for use contain not more than 0.06 percent lead by weight of the total nonvolatile. Certificate stating that paints proposed for use meet Federal VOC regulations and those of the of the local Air Pollution Control Districts having jurisdiction over the geographical area in which the project is located.

### 1.3 PACKAGING, LABELING, AND STORING

Paints shall be in sealed containers that legibly show the designated name, formula or specification number, batch number, color, quantity, date of manufacture, manufacturer's formulation number, manufacturer's directions including any warnings and special precautions, and name of manufacturer. Pigmented paints shall be furnished in containers not larger than 5 gallons.

Paints and thinner shall be stored in accordance with the manufacturer's written directions and as a minimum stored off the ground, under cover, with sufficient ventilation to prevent the buildup of flammable vapors and



at temperatures between 40 and 95 degrees F. Paints shall be stored on the project site or segregated at the source of supply sufficiently in advance of need to allow 30 days for testing.

#### 1.4 APPROVAL OF MATERIALS

When samples are tested, approval of materials will be based on tests of the samples; otherwise, materials will be approved based on test reports furnished with them. If materials are approved based on test reports furnished, samples will be retained by the Government for testing should the materials appear defective during or after application. In addition to any other remedies under the contract the cost of retesting defective materials will be at the Contractor's expense.

#### 1.5 ENVIRONMENTAL CONDITIONS

Unless otherwise recommended by the paint manufacturer, the ambient temperature shall be between 45 and 95 degrees F when applying coatings other than water-thinned, epoxy, and moisture-curing polyurethane coatings.

Water-thinned coatings shall be applied only when ambient temperature is between 50 and 90 degrees F. Epoxy, and moisture-curing polyurethane coatings shall be applied only within the minimum and maximum temperatures recommended by the coating manufacturer. Moisture-curing polyurethane shall not be applied when the relative humidity is below 30 percent.

#### 1.6 SAFETY AND HEALTH

Work shall comply with applicable Federal, State, and local laws and regulations, and with the ACCIDENT PREVENTION PLAN, including the Activity Hazard Analysis as specified in the CONTRACT CLAUSES. The Activity Hazard Analysis shall include analyses of the potential impact of painting operations on painting personnel and on others involved in and adjacent to the work zone.

##### 1.6.1 Worker Exposures

Exposure of workers to hazardous chemical substances shall not exceed limits established by ACGIH Limit Values, or as required by a more stringent applicable regulation.

##### 1.6.2 Toxic Compounds

Toxic products having ineffective physiological warning properties, such as no or low odor or irritation levels, shall not be used unless approved by the Contracting Officer.

##### 1.6.3 Training

Workers having access to an affected work area shall be informed of the contents of the applicable material data safety sheets (MDSS) and shall be informed of potential health and safety hazard and protective controls associated with materials used on the project. An affected work area is one which may receive mists and odors from the painting operations. Workers involved in preparation, painting and clean-up shall be trained in

the safe handling and application, and the exposure limit, for each material which the worker will use in the project. Personnel having a need to use respirators and masks shall be instructed in the use and maintenance of such equipment.

#### 1.6.4 Coordination

Work shall be coordinated to minimize exposure of building occupants, other Contractor personnel, and visitors to mists and odors from preparation, painting and clean-up operations.

### PART 2 PRODUCTS

#### 2.1 PAINT

The term "paint" as used herein includes emulsions, enamels, paints, stains, varnishes, sealers, cement-emulsion filler, and other coatings, whether used as prime, intermediate, or finish coat. Paint shall conform to the requirements listed in the painting schedules at the end of this section, except when the required amount of a material of a particular batch is 50 gallons or less, an approved first-line proprietary paint material with similar intended formulation, usage and color to that specified may be used. Additional requirements are as follows:

##### 2.1.1 Colors and Tints

Colors shall be as selected from manufacturer's standard colors, as indicated. Manufacturer's standard color is for identification of color only. Tinting of epoxy and urethane paints shall be done by the manufacturer. Stains shall conform in shade to manufacturer's standard color. The color of the undercoats shall vary slightly from the color of the next coat.

##### 2.1.2 Lead

Paints containing lead in excess of 0.06 percent by weight of the total nonvolatile content (calculated as lead metal) shall not be used.

##### 2.1.3 Chromium

Paints containing zinc chromate or strontium chromate pigments shall not be used.

##### 2.1.4 Volatile Organic Compound (VOC) Content

Paints shall comply with applicable federal, state and local laws enacted to insure compliance with Federal Clean Air Standards and shall conform to the restrictions of the local air pollution control authority.

### PART 3 EXECUTION

#### 3.1 PROTECTION OF AREAS NOT TO BE PAINTED

Items not to be painted which are in contact with or adjacent to painted

surfaces shall be removed or protected prior to surface preparation and painting operations. Items removed prior to painting shall be replaced when painting is completed. Following completion of painting, workmen skilled in the trades involved shall reinstall removed items. Surfaces contaminated by coating materials shall be restored to original condition.

### 3.2 SURFACE PREPARATION

Surfaces to be painted shall be clean and free of foreign matter before application of paint or surface treatments. Oil and grease shall be removed prior to mechanical cleaning. Cleaning shall be programmed so that dust and other contaminants will not fall on wet, newly painted surfaces. Exposed ferrous metals such as nail heads on or in contact with surfaces to be painted with water-thinned paints, shall be spot-primed with a suitable corrosion-inhibitive primer capable of preventing flash rusting and compatible with the coating specified for the adjacent areas.

#### 3.2.1 Concrete and Masonry Surfaces

Concrete and masonry surfaces shall be allowed to dry at least 30 days before painting, except concrete slab on grade which shall be allowed to cure 90 days before painting. Surfaces shall be cleaned in accordance with ASTM D 4258. Glaze, efflorescence, laitance, dirt, grease, oil, asphalt, surface deposits of free iron and other foreign matter shall be removed prior to painting. Surfaces to receive polyurethane or epoxy coatings shall be acid-etched or mechanically abraded as specified by the coating manufacturer, rinsed with water, allowed to dry, and treated with the manufacturer's recommended conditioner prior to application of the first coat.

#### 3.2.2 Ferrous Surfaces

Ferrous surfaces including those that have been shop-coated, shall be solvent-cleaned or detergent-washed in accordance with SSPC SP 1. Surfaces that contain loose rust, loose mill scale, and other foreign substances shall be cleaned mechanically with hand tools according to SSPC SP 2, power tools according to SSPC SP 3 or by sandblasting according to SSPC SP 7/NACE 4. Shop-coated ferrous surfaces shall be protected from corrosion by treating and touching up corroded areas immediately upon detection.

#### 3.2.3 Nonferrous Metallic Surfaces

Galvanized, aluminum and aluminum-alloy, lead, copper, and other nonferrous metal surfaces shall be solvent-cleaned or detergent-washed in accordance with SSPC SP 1.

#### 3.2.4 Gypsum Board Surfaces

Gypsum board surfaces shall be dry and shall have all loose dirt and dust removed by brushing with a soft brush, rubbing with a cloth, or vacuum-cleaning prior to application of the first-coat material. A damp cloth or sponge may be used if paint will be water-based.

#### 3.2.5 Wood Surfaces

Wood surfaces shall be cleaned of foreign matter. Moisture content of the wood shall not exceed 12 percent as measured by a moisture meter, unless otherwise authorized. Wood surfaces adjacent to surfaces to receive water-thinned paints shall be primed and/or touched up before applying water-thinned paints. Small, dry seasoned knots shall be scraped, cleaned, and given a thin coat of commercial knot sealer, before application of the priming coat. Pitch on large, open, unseasoned knots and all other beads or streaks of pitch shall be scraped off, or, if it is still soft, removed with mineral spirits or turpentine, and the resinous area shall be thinly coated with knot sealer. Finishing nails shall be set, and all holes and surface imperfections shall be primed. After priming, holes and imperfections in finish surfaces shall be filled with putty or plastic wood filler, colored to match the finish coat if natural finish is required, allowed to dry, and sanded smooth. Putty or wood filler shall be compatible with subsequent coatings.

### 3.3 MIXING AND THINNING

When thinning is approved as necessary to suit surface, temperature, weather conditions, or application methods, paints may be thinned in accordance with the manufacturer's directions. When thinning is allowed, paints shall be thinned immediately prior to application with not more than 1 pint of suitable thinner per gallon. The use of thinner shall not relieve the Contractor from obtaining complete hiding, full film thickness, or required gloss. Thinning shall not cause the paint to exceed limits on volatile organic compounds. Paints of different manufacturers shall not be mixed.

#### 3.3.1 Cement-Emulsion Filler Coat

Cement and aggregate shall be dry-mixed so that uniform distribution and intermixing are obtained. Mixing liquid and one-half of the total amount of water shall be premixed and added gradually to the white portland cement and aggregate with constant stirring until a thick, smooth material is obtained. Emulsion paint shall then be added to the mixture and stirred until uniformity is obtained. The blend shall have a thick, creamy consistency. The remainder of the water shall be added if necessary to obtain a material with adequate application properties. Blending resin emulsion or emulsion paint with any other component shall be done with caution; too rapid an agitation will cause air entrapment and foaming.

#### 3.3.2 Two-Component Systems

Two-component systems shall be mixed in accordance with manufacturer's instructions. Any thinning of the first coat to ensure proper penetration and sealing shall be as recommended by the manufacturer for each type of substrate.

### 3.4 APPLICATION

Painting practices shall comply with applicable federal, state and local laws enacted to insure compliance with Federal Clean Air Standards. Unless otherwise specified or recommended by the paint manufacturer, paint may be

applied by brush, roller, or spray. At the time of application, paint shall show no signs of deterioration. Uniform suspension of pigments shall be maintained during application. Each coat of paint shall be applied so dry film shall be of uniform thickness and free from runs, drops, ridges, waves, pinholes or other voids, laps, brush marks, and variations in color, texture, and finish. Hiding shall be complete. Rollers for applying paints and enamels shall be of a type designed for the coating to be applied and the surface to be coated. Special attention shall be given to insure that all edges, corners, crevices, welds, and rivets receive a film thickness equal to that of adjacent painted surfaces. Paints, except water-thinned types, shall be applied only to surfaces that are completely free of moisture as determined by sight or touch.

#### 3.4.1 Ventilation

Affected areas shall be ventilated during paint application so that workers exposure to chemical substances shall not exceed limits as established by ACGIH Limit Values, or as required by a more stringent applicable regulation. Interior work zones having a volume of 10,000 cubic feet or less shall be ventilated at a minimum of 2 air exchanges per hour. Ventilation in larger work zones shall be maintained by means of mechanical exhaust. Solvent vapors shall be exhausted outdoors, away from air intakes and workers. Return air inlets in the work zone shall be temporarily sealed before start of work until the coatings have dried.

#### 3.4.2 Respirators

Operators and personnel in the vicinity of operating paint sprayers shall wear respirators.

#### 3.4.3 First Coat

The first coat on gypsum wallboard, and other surfaces shall include repeated touching up of suction spots or overall application of primer or sealer to produce uniform color and gloss. Excess sealer shall be wiped off after each application. Glazed doors and sashes shall be given the specified coating system within 3 weeks of the time they are glazed, but not before the glazing material has set; paint shall overlay glass about 70 mils all around. Each varnish coat shall be sanded lightly prior to application of subsequent coats.

#### 3.4.4 Timing

Surfaces that have been cleaned, pretreated, and otherwise prepared for painting shall be given a coat of the specified first coat as soon as practical after such pretreatment has been completed, but prior to any deterioration of the prepared surface. Sufficient time shall elapse between successive coats to permit proper drying. This period shall be modified as necessary to suit weather conditions. Oil-based or oleoresinous solvent-type paints shall be considered dry for recoating when the paint feels firm, does not deform or feel sticky under moderate pressure of the thumb, and the application of another coat of paint does not cause the undercoat to lift or lose adhesion. Manufacturer's instructions for application, curing and drying time between coats of

two-component systems shall be followed.

#### 3.4.5 Stains

Stain shall be applied at the rate specified in the manufacturer's printed directions. Oil-type stain shall be applied by brushing with the grain for the full length of the board or course of siding.

#### 3.4.6 Fillers

Concrete and masonry surface voids shall be filled; however, surface irregularities need not be completely filled. The dried filler shall be uniform and free of pinholes. Filler shall not be applied over caulking compound.

##### 3.4.6.1 Cement-Emulsion Filler

Immediately before filler application, surfaces shall be dampened uniformly and thoroughly, with no free surface water visible, by several applications of potable water with a fog spray, allowing time between the sprayings for water to be absorbed. Cement-emulsion filler shall be scrubbed into the surface vigorously with a stiff-bristled brush having tampico or palmyra bristles not longer than 2-1/2 inches. At least 24 hours shall elapse before applying exterior emulsion paint over cement-emulsion filler. When the ambient temperature is over 85 degrees F, cement-emulsion filler surfaces shall be dampened lightly with a fog spray of potable water immediately prior to application of the subsequent paint coat.

##### 3.4.6.2 Latex Filler

Latex filler, CID A-A-1500, shall be applied according to the manufacturer's instructions. Surface voids shall be filled and excess filler shall be removed from the surface with a rubber squeegee. The filler shall be allowed to dry the length of time specified by the manufacturer prior to applying successive coats of paint.

#### 3.4.7 Textured Coating

Application of textured coating, FS TT-C-555, shall be as specified in the manufacturer's printed directions.

#### 3.4.8 Ferrous-Metal Primer

Primer for ferrous-metal shall be applied to ferrous surfaces to receive paint other than asphalt varnish prior to deterioration of the prepared surface. The semitransparent film applied to some pipes and tubing at the mill is not to be considered a shop coat, but shall be overcoated with the specified ferrous-metal primer prior to application of finish coats.

### 3.5 PIPE COLOR CODE MARKING

Pipes in exposed areas and in accessible pipe spaces shall be provided with color band and titles adjacent to all valves, except those provided at plumbing fixtures, at not more than 40 foot spacing on straight pipe runs,

adjacent to change in direction, and on both sides where pipes pass through walls or floors. Color code marking shall be of the color listed in TABLE I and the size listed in TABLE II. The arrows shall be installed adjacent to each band to indicate the direction of flow in the pipe. The legends shall be printed in upper-case black letters as listed in TABLE I. Letter sizes shall be as listed in TABLE II. Marking shall be painted or applied using colored, pressure-sensitive adhesive markers of standard manufacture.

Paint shall be as specified for insulated and uninsulated piping. THIS LIST SHALL BE REVIEWED BY MEP DISCIPLINES BEFORE 90% SUBMITTAL.

TABLE I. COLOR CODES FOR MARKING PIPE

| Material                           | Band   | Letters and<br>Arrow* | Legend          |
|------------------------------------|--------|-----------------------|-----------------|
| Cold water (potable)               | Green  | White                 | POTABLE WATER   |
| Fire protection water              | Red    | White                 | FIRE PR. WATER  |
| Fire Sprinkler Water               | Red    | White                 | FIRE SPR. WATER |
| Hot water (domestic)               | Green  | White                 | H.W.            |
| Hot water recirculating (domestic) | Green  | White                 | H.W.R.          |
| Boiler feed water                  | Yellow | Black                 | B.F.            |
| Low temp. water supply (heating)   | Yellow | Black                 | L.T.W.S.        |
| Low temp. water return (heating)   | Yellow | Black                 | L.T.W.R.        |
| Chilled water supply               | Green  | White                 | C.H.W.S.        |
| Chilled water return               | Green  | White                 | C.H.W.R.        |
| Treated water                      | Green  | White                 | TR. WATER       |
| Chemical feed                      | Yellow | Black                 | CH. FEED        |
| Compressed air                     | Blue   | White                 | COMP. AIR       |
| Natural gas                        | Yellow | Black                 | NAT. GAS        |
| Refrigerants                       | Blue   | White                 | REFRIGERANT     |

TABLE I. COLOR CODES FOR MARKING PIPE

| Material                            | Band   | Letters and Arrow* | Legend                   |
|-------------------------------------|--------|--------------------|--------------------------|
| Hydraulic fluid under 600 psi       | Green  | White              | HYDRAULIC FLUID-_____PSI |
| Hydraulic fluid 600 psi and Greater | Yellow | Black              | HYDRAULIC FLUID-_____PSI |

TABLE II. COLOR CODE MARKING SIZES

| Outside Diameter of Pipe Covering (Inches) | Length of Color Band (inches) | Arrow Length x Width (Inches) | Size of Legend Letters and Numerals (Inches) |
|--|-------------------------------|-------------------------------|--|
| Less than 1-1/2                            | 8                             | 8 x 2-1/4                     | 1/2  |
| 1-1/2 to 2-3/8                             | 8                             | 8 x 2-1/4                     | 3/4  |
| 2-1/2 to 7-7/8                             | 12                            | 8 x 2-1/4                     | 1-1/4  |
| 8 to 10                                    | 24                            | 12 x 4-1/2                    | 2-1/2  |
| Over 10                                    | 32                            | 12 x 4-1/2                    | 3-1/2  |

### 3.6 MISCELLANEOUS PAINTING

#### 3.6.1 Lettering

Lettering shall be provided as scheduled on the drawings, shall be block type, and shall be black enamel or water-type decalcomania, finished with a protective coating of spar varnish. Samples shall be approved before application.

#### 3.7 SURFACES TO BE PAINTED

Surfaces listed in the painting schedules at the end of this section, other than those listed in paragraph SURFACES NOT TO BE PAINTED, shall be painted as scheduled.

#### 3.8 SURFACES NOT TO BE PAINTED

Surfaces in the following areas shall not to be painted: exterior concrete and concrete unit masonry. In addition, surfaces of hardware, fittings, and other factory finished items shall not be painted.

#### 3.9 CLEANING

Cloths, cotton waste and other debris that might constitute a fire hazard shall be placed in closed metal containers and removed at the end of each day. Upon completion of the work, staging, scaffolding, and containers



shall be removed from the site or destroyed in an approved manner. Paint and other deposits on adjacent surfaces shall be removed and the entire job left clean and acceptable.

### 3.10 PAINTING SCHEDULES

The following painting schedules identify the surfaces to be painted and prescribe the paint to be used and the number of coats of paint to be applied. Contractor options are indicated by -----or----- between optional systems or coats.

#### EXTERIOR PAINTING SCHEDULE

| <u>Surface</u>   | <u>First Coat</u>                        | <u>Second Coat</u>                      | <u>Third Coat</u>               |
|--|--|---|---------------------------------|
| Stucco.  | FS TT-E-2784<br>Type III                 | FS TT-E-2784<br>Type III                | None                            |
| Wood, unless<br>otherwise<br>specified.  | CID A-A-2336                             | FS TT-E-2784<br>Type II                 | FS TT-E-2784<br>Type II         |
| Galvanized<br>metal.   | FS TT-E-2784<br>Type III                 | FS TT-E-2784<br>Type II                 | FS TT-E-2784<br>Type II         |
| Aluminum<br>aluminum-alloy,<br>and other non-<br>ferrous metal<br>(non-galvanized) | CID A-A-2867<br>FS TT-E-2784<br>Type III | CID A-A-2867<br>FS TT-E-2784<br>Type II | None<br>FS TT-E-2784<br>Type II |

INTERIOR PAINTING SCHEDULE

| <u>Surface</u>  | <u>First Coat</u>   | <u>Second Coat</u>       | <u>Third Coat</u>       |
|---|---|--------------------------|-------------------------|
| Gypsum board, concrete, and concrete masonry units not requiring a smooth finish, unless otherwise specified. | CID A-A-2994<br>Type II   | CID A-A-2247             | CID A-A-2247            |
| Concrete masonry units requiring a smooth finish  | CID A-A-1500  | CID A-A-2994<br>Type II  | CID A-A-2247            |
| Concrete: floors requiring dust reduction in scheduled areas  | CID A-A-2542<br>Type I  | None                     | None                    |
| Ferrous Metal unless otherwise specified  | SSPC Paint 23   | FS TT-E-2784<br>Type II  | FS TT-E-2784<br>Type II |
| Aluminum and aluminum alloy unless otherwise specified.   | FS TT-E-2784<br>Type III  | FS TT-E-2784<br>Type II  | FS TT-E-2784<br>Type II |
| Ferrous metal factory-primed mechanical and electrical equipment.   | Two coats of paint as recommended by the equipment manufacturer |                          | None                    |
| Galvanized metal:   | FS TT-E-2784<br>Type III  | FS TT-E-2784<br>Type III | None                    |

|  |  |  |                                   |
|--|--|--|-----------------------------------|
| Wood:<br>unless otherwise<br>specified.  | CID A-A-2994<br>Type I                           | CID A-A-2247   | None                              |
| Wood: stain and<br>varnish finishes<br>as follows:<br>Doors, moldings<br>and trim as<br>indicated  | CID A-A-2339                                     | CID A-A-2834<br>Type I<br>Class I<br><br>In addition a fourth coat of<br>CID A-A-2834<br>Type I<br>Class I | CID A-A-2834<br>Type I<br>Class I |
| Ferrous Metal:<br>Electrical<br>conduit runs:<br>metallic tubing<br>uninsulated ducts<br>and pipes, pipe<br>hangers, louvers,<br>grilles, and air<br>outlets, in areas<br>having painted<br>adjacent surfaces                            | SSPC Paint 23                                    | None   | None                              |
| Aluminum and Galvanized Surface Metal:<br>Electrical<br>conduit runs<br>metallic tubing<br>uninsulated<br>ducts and pipes,<br>pipe hangers,<br>louvers, grilles,<br>and air outlets,<br>in areas having<br>painted adjacent<br>surfaces. | FS TT-E-2784                                     | CID A-A-2246   | CID A-A-2247                      |
| Facing of vapor<br>barrier jackets<br>of presized or<br>adhesive<br>finished cloth<br>cover insulation<br>on pipes, ducts,<br>and equipment in<br>where exposed<br>to view.  | Two coats of paint<br>to match<br>adjacent areas |  | None                              |

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DIVISION 10 - SPECIALTIES

SECTION 10100

VISUAL COMMUNICATIONS SPECIALTIES

**11/00**

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- 1.2 GENERAL REQUIREMENTS
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- 2.2 MATERIALS
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  - 2.2.3 Omitted
  - 2.2.4 Omitted
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-- End of Section Table of Contents --

CEGS-10100 (November 2000)

SECTION 10100

VISUAL COMMUNICATIONS SPECIALTIES

11/00

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM B 221 (1996) Aluminum and Aluminum-Alloy  
Extruded Bars, Rods, Wire, Profiles, and  
Tubes

1.2 GENERAL REQUIREMENTS

The term visual display board when used herein includes presentation boards, marker boards, tackboards, board cases, display track system and horizontal sliding units. Visual display boards shall be from manufacturer's standard product line.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-03 Product Data

Visual Display Boards

Manufacturer's descriptive data and catalog cuts.  
Manufacturer's installation instructions, and cleaning and  
maintenance instructions.

07 Certificates

Visual Display Boards;

Certificate of compliance signed by Contractor attesting that  
visual display boards conform to the requirements specified.

#### 1.4 DELIVERY, STORAGE AND HANDLING

Materials shall be delivered to the building site in the manufacturer's original unopened containers and shall be stored in a clean dry area with temperature maintained above 50 degrees F. Materials shall be stacked according to manufacturer's recommendations. Visual display boards shall be allowed to acclimate to the building temperature for 24 hours prior to installation.

#### 1.5 WARRANTY

Manufacturer's standard performance guarantees or warranties that extend beyond a one year period shall be provided.

### PART 2 PRODUCTS

#### 2.1 COLOR

Finish colors for required items shall be as specified in the drawings.

#### 2.2 MATERIALS

##### 2.2.1 Porcelain Enamel

Marker board writing surface shall be composed of porcelain enamel fused to a nominal 28 gauge (0.0149 inches) thick steel, laminated to a minimum 1/4 inch thick core material with a steel or foil backing sheet. Writing surface shall be capable of supporting paper by means of magnets. Marker board surface for display track system may be a powder paint dry erase surface adhered to a nominal 18 gauge (0.0478 inches) thick steel.

##### 2.2.2 Omitted

##### 2.2.3 Omitted

##### 2.2.4 Omitted

##### 2.2.5 Omitted

##### 2.2.6 Aluminum

Aluminum frame extrusions shall be alloy 6063-T5 or 6063-T6, conform to ASTM B 221, and be a minimum 0.06 inches thick. Exposed aluminum shall have an anodized, satin finish. Straight, single lengths shall be used wherever possible. Joints shall be kept to a minimum. Corners shall be mitered and shall have a hairline closure.

#### 2.3 OMITTED

#### 2.4 MARKERBOARD

Markerboard shall have a porcelain enamel writing surface and a chalktray. Markerboard shall be a factory assembled unit complete in one piece, without joints whenever possible. When markerboard dimensions require delivery in separate sections, components shall be prefit at the factory, disassembled for delivery and jointed at the site. Frame shall be aluminum. Chalktray shall be the same material as the frame and extend the

full length of the liquid markerboard. The markerboard shall not include a map rail Dry erase markings shall be removable with a felt eraser or dry cloth without ghosting. Each unit shall come complete with an eraser and four different color compatible dry erase markers. The size shall be as shown in the drawings.

### PART 3 EXECUTION

#### 3.1 OMITTED

#### 3.2 INSTALLATION

Installation and assembly shall be in accordance with manufacturer's printed instructions. Concealed fasteners shall be used. Visual display boards shall be attached to the walls with suitable devices to anchor each unit. The Contractor shall furnish and install trim items, accessories and miscellaneous items in total, including but not limited to hardware, grounds, clips, backing materials, adhesives, brackets, and anchorages incidental to or necessary for a sound, secure, complete and finished installation. Installation shall not be initiated until completion of room painting and finishing operations. Visual display boards shall be installed in locations and at mounting heights indicated. Visual display boards shall be installed level and plumb, and if applicable doors shall be aligned and hardware shall be adjusted. Damaged units shall be repaired or replaced by the Contractor as directed by the Contracting Officer.

#### 3.3 CLEANING

Writing surfaces shall be cleaned in accordance with manufacturer's instructions.

-- End of Section --

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SECTION 10201

METAL WALL LOUVERS

**09/99**

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- 2.2 METAL WALL LOUVERS
  - 2.2.1 Extruded Aluminum Louvers
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    - 2.5.1.2 Organic Coating

PART 3 EXECUTION

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UFGS-10201N (September 1999)

SECTION 10201

METAL WALL LOUVERS

09/99

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

AMERICAN ARCHITECTURAL MANUFACTURERS ASSOCIATION (AAMA)

AAMA 603.8 (1992; Addendum 1993) Pigmented Organic Coatings on Extruded Aluminum

AIR MOVEMENT AND CONTROL ASSOCIATION (AMCA)

AMCA 500 (1991) Louvers, Dampers and Shutters

AMCA 511 (1991) Certified Ratings Program for Air Control Devices

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM B 221 (1996) Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Wall louvers

Show all information necessary for fabrication and installation of louvers. Indicate materials, sizes, thicknesses, fastenings, and profiles.

1.3 DELIVERY, STORAGE, AND PROTECTION

Deliver materials to the site in an undamaged condition. Carefully store

materials off the ground to provide proper ventilation, drainage, and protection against dampness. Louvers shall be free from nicks, scratches, and blemishes. Replace defective or damaged materials with new.

## PART 2 PRODUCTS

### 2.1 MATERIALS

2.1.1 Omitted

2.1.2 Omitted

2.1.3 Extruded Aluminum

ASTM B 221, alloy 6063-T5 or -T52.

### 2.2 METAL WALL LOUVERS

Weather resistant type, with bird screens and made to withstand a wind load of not less than 30 pounds per square foot. Wall louvers shall bear the AMCA certified ratings program seal for air performance and water penetration in accordance with AMCA 500 and AMCA 511. The rating shall show a water penetration of 0.20 or less ounce per square foot of free area at a free velocity of 800 feet per minute. Free area ratio shall be not less than 50 percent.

2.2.1 Extruded Aluminum Louvers

Fabricated of extruded 6063-T5 or -T52 aluminum with a wall thickness of not less than 0.081 inch.

2.2.2 Omitted

2.2.3 Omitted

2.2.4 Screens and Frames

For aluminum louvers, provide 1/2 inch square mesh, 14 or 16 gage aluminum or 1/4 inch square mesh, 16 gage aluminum bird screening. Mount screens in removable, rewirable frames of same material and finish as the louvers.

2.3 OMITTED

2.4 FASTENERS AND ACCESSORIES

Provide stainless steel screws and fasteners for aluminum louvers and zinc-coated or stainless steel screws and fasteners for steel louvers. Provide other accessories as required for complete and proper installation.

2.5 FINISHES

2.5.1 Aluminum

Provide factory-applied organic coating.

2.5.1.1 Omitted

2.5.1.2 Organic Coating

Clean and prime exposed aluminum surfaces and apply a baked enamel finish conforming to AAMA 603.8, 0.8 mil minimum dry film thickness, color as indicated.

PART 3 EXECUTION

3.1 INSTALLATION

3.1.1 Wall Louvers

Install using stops or moldings, flanges, strap anchors, or jamb fasteners as appropriate for the wall construction and in accordance with manufacturer's recommendations.

3.1.2 Omitted

3.1.3 Screens and Frames

Attach frames to louvers with screws or bolts.

3.2 PROTECTION FROM CONTACT OF DISSIMILAR MATERIALS

3.2.1 Omitted

3.2.2 Aluminum

Where aluminum contacts metal other than zinc, paint the dissimilar metal with a primer and two coats of aluminum paint.

3.2.3 Metal

Paint metal in contact with mortar, concrete, or other masonry materials with alkali-resistant coatings such as heavy-bodied bituminous paint.

3.2.4 Wood

Paint wood or other absorptive materials that may become repeatedly wet and in contact with metal with two coats of aluminum paint or a coat of heavy-bodied bituminous paint.

-- End of Section --

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SECTION 10440

INTERIOR SIGNAGE

**06/98**

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  - 3.1.1 Omitted
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-- End of Section Table of Contents --

CEGS-10440 (June 1998)

Includes changes through Notice 2 (February 2001)

SECTION 10440

INTERIOR SIGNAGE

**06/98**

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI Z97.1 (1984; Rev 1994) Safety Performance  
Specifications and Methods of Test for  
Safety Glazing Materials Used in Buildings

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Detail Drawings

Drawings showing elevations of each type of sign, dimensions, details and methods of mounting or anchoring, shape and thickness of materials, and details of construction. A schedule showing the location, each sign type, and message shall be included.

SD-03 Product Data

Installation

Manufacturer's descriptive data, catalogs cuts, installation and cleaning instructions.

1.3 GENERAL

Interior signage shall be of the design, detail, sizes, types, and message content shown on the drawings, shall conform to the requirements specified,

and shall be provided at the locations indicated. Signs shall be complete with lettering, framing as detailed, and related components for a complete installation.

1.3.1 Omitted

1.3.2 Raised and Brailled Characters

Letters and numbers on signs shall be raised 3/64 inch upper case, sans serif or simple serif type and shall be accompanied with Grade 2 Braille. Raised characters shall be at least 5/8 inch in height, but no higher than 2 inches.

1.4 QUALIFICATIONS

Signs and plaques, shall be the standard product of a manufacturer regularly engaged in the manufacture of such products and shall essentially duplicate signs that have been in satisfactory use at least 2 years prior to bid opening.

1.5 DELIVERY AND STORAGE

Materials shall be delivered to the jobsite in manufacturer's original packaging and stored in a clean, dry area in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.1 ROOM IDENTIFICATION/DIRECTIONAL SIGNAGE SYSTEM

Signs shall be fabricated of acrylic plastic conforming to ANSI Z97.1.

2.1.1 Standard Room Signs

Signs shall consist of matte finish acrylic plastic. Units shall be frameless. Corners of signs shall be as shown.

2.1.2 Changeable Message Strip Signs

Changeable message strip signs shall consist of cast acrylic plastic captive message slider sign face with message slots and associated end caps, as detailed, for insertion of changeable message strips. Size of signs shall be as shown on the drawings. Individual message strips to permit removal, change, and reinsertion shall be provided as detailed. Corners of signs shall be square.

2.1.3 Type of Mounting For Signs

Extruded aluminum brackets, mounted as shown, shall be furnished for hanging, projecting, and double-sided signs. Mounting for framed, hanging, and projecting signs shall be by mechanical fasteners. Surface mounted signs shall be provided with countersunk mounting holes in plaques and mounting screws. Sign inserts shall be provided with 1/16 inch thick foam tape.

#### 2.1.4 Graphics

Signage graphics for modular identification/directional signs shall conform to the following:

Acrylic letters 3/64 inch thick and chemically welded to 0.125 inch thick acrylic backup sheet.

- 2.2 OMITTED
- 2.3 OMITTED
- 2.4 OMITTED
- 2.5 OMITTED
- 2.6 OMITTED
- 2.7 OMITTED

#### 2.8 FABRICATION AND MANUFACTURE

##### 2.8.1 Factory Workmanship

Holes for bolts and screws shall be drilled or punched. Drilling and punching shall produce clean, true lines and surfaces. Exposed surfaces of work shall have a smooth finish and exposed riveting shall be flush. Fastenings shall be concealed where practicable.

#### 2.9 COLOR

Color shall be white letters on standard USAF blue background.

### PART 3 EXECUTION

#### 3.1 INSTALLATION

Signs shall be installed in accordance with approved manufacturer's instructions at locations shown on the detail drawings. Signs shall be installed plumb and true at mounting heights indicated, and by method shown or specified. Required blocking shall be installed as detailed. Signs which designate permanent rooms and spaces in handicapped-accessible buildings shall be installed on the wall adjacent to the latch side of the door. Where there is no wall space to the latch side of the door, including at double leaf doors, signs shall be placed on the nearest adjacent wall. Mounting location for such signage shall be so that a person may approach within 3 inches of signage without encountering protruding objects or standing within the swing of a door. Signs on doors or other surfaces shall not be installed until finishes on such surfaces have been installed. Signs installed on glass surfaces shall be installed with matching blank back-up plates in accordance with manufacturer's instructions.

##### 3.1.1 Omitted

##### 3.1.2 Protection and Cleaning

The work shall be protected against damage during construction. Hardware

and electrical equipment shall be adjusted for proper operation. Glass, frames, and other sign surfaces shall be cleaned in accordance with the manufacturer's approved instructions.

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DIVISION 12 - FURNISHINGS

SECTION 12490

WINDOW TREATMENT

**01/98**

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PART 2 PRODUCTS

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  - 2.1.1 Horizontal Blinds
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PART 3 EXECUTION

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-- End of Section Table of Contents --

CEGS-12490 (January 1998)

SECTION 12490

WINDOW TREATMENT

01/98

PART 1 WORK DESCRIPTION

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

FEDERAL SPECIFICATIONS (FS)

FS AA-V-00200 (Rev B) Venetian Blinds

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Approved Detail Drawings

Drawings showing fabrication and installation details. Drawings shall show layout and locations of track, direction of draw, mounting heights, and details.

SD-03 Product Data

Window Treatments  
Hardware

Manufacturer's data composed of catalog cuts, brochures, product information, and maintenance instructions.

SD-04 Samples

Window Treatments

Three samples of each type and color of window treatment. Blind slats or louvers shall be 6 inches in length for each color. Track shall be 6 inches in length. Shade material shall be minimum 6 x 6 inches in size.

### 1.3 GENERAL

Window treatment shall be provided, complete with necessary brackets, fittings, and hardware. Each window treatment type shall be a complete unit provided in accordance with paragraph WINDOW TREATMENT PLACEMENT SCHEDULE. Equipment shall be mounted and operated as indicated. Windows to receive a treatment shall be completely covered. The Contractor shall take measurements at the building and shall be responsible for the proper fitting and hanging of the equipment.

### 1.4 DELIVERY, STORAGE, AND HANDLING

Components shall be delivered to the jobsite in the manufacturer's original packaging with the brand or company name, item identification, and project reference clearly marked. Components shall be stored in a dry location that is adequately ventilated and free from dust, water, or other contaminants and shall have easy access for inspection and handling. Materials shall be stored flat in a clean dry area with temperature maintained above 50 degrees F.

### 1.5 FIELD MEASUREMENTS

The Contractor shall become familiar with details of the work, verify dimensions in the field, and shall advise the Contracting Officer of any discrepancy before performing the work.

### 1.6 WARRANTY

Manufacturer's standard performance guarantees or warranties that extend beyond a 1 year period shall be provided.

## PART 2 PRODUCTS

### 2.1 WINDOW BLINDS

Each blind, including hardware, accessory items, mounting brackets and fastenings, shall be provided as a complete unit produced by one manufacturer. All parts shall be one color unless otherwise shown, and match the color of the blind slat. Steel features shall be treated for corrosion resistance.

#### 2.1.1 Horizontal Blinds

Horizontal blinds shall conform to FS AA-V-00200, Type II ( 1 inch slats), except as modified below. Blind units shall be capable of nominally 180 degree partial tilting operation and full-height raising. Blinds shall be inside mount as shown.

##### 2.1.1.1 Head Channel and Slats

Head channel shall be steel or aluminum nominal 0.018 in. 0.024 for Type II. Slats shall be aluminum, not less than 0.008 inch thick, and of sufficient strength to prevent sag or bow in the finished blind. A

sufficient amount of slats shall be provided to assure proper control, uniform spacing, and adequate overlap.

#### 2.1.1.2 Controls

The slats shall be tilted by a transparent tilting wand, hung vertically by its own weight, and shall swivel for easy operation. The tilter control shall be of enclosed construction. Moving parts and mechanical drive shall be made of compatible materials which do not require lubrication during normal expected life. The tilter shall tilt the slats to any desired angle and hold them at that angle so that any vibration or movement of ladders and slats will not drive the tilter and change the angle of slats. A mechanism shall be included to prevent over tightening. The wand shall be of sufficient length to reach to within 5 feet of the floor.

#### 2.1.1.3 Intermediate Brackets

Intermediate brackets shall be provided for installation of blinds over 60 inches wide and shall be installed as recommended by the manufacturer.

#### 2.1.1.4 Hold-Down Brackets

Universal type hold-down brackets for sill or jamb mount shall be provided.

### 2.2 OMITTED

### 2.3 COLOR

Color shall be as indicated or, if not indicated, selected from the manufacturer's standard colors to match existing.

## PART 3 EXECUTION

### 3.1 WINDOW TREATMENT PLACEMENT SCHEDULE

Horizontal window blinds shall be provided for all type A windows.

### 3.2 INSTALLATION

Installation shall be in accordance with the approved detail drawings and manufacturer's installation instructions. Units shall be level, plumb, secure, and at proper height and location relative to window units. The Contractor shall furnish and install supplementary or miscellaneous items in total, including clips, brackets, or anchorages incidental to or necessary for a sound, secure, and complete installation. Installation shall not be initiated until completion of room painting and finishing operations. Upon completion of the installation, window treatments shall be adjusted for form and appearance, shall be in proper operating condition, and shall be free from damage or blemishes. Damaged units shall be repaired or replaced by the Contractor as directed by the Contracting Officer.

-- End of Section --

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DIVISION 12 - FURNISHINGS

SECTION 12600

THEATER CHAIRS

01/98

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    - 2.2.1.2 Wood Front Panels
    - 2.2.1.3 Foam Padding
  - 2.2.2 Seats
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  - 2.2.3 Hinges
  - 2.2.4 Standards
    - 2.2.4.1 Floor Standards
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PART 3 EXECUTION

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-- End of Section Table of Contents --

CEGS-12600 (January 1998)

SECTION 12600

THEATER CHAIRS

01/98

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 3597 (1995a) Woven Upholstery Fabrics-Plain,  
Tufted, or Flocked

HARDWOOD PLYWOOD VENEER ASSOCIATION (HPVA)

HPVA HP-1 (1994) Interim Voluntary Standard for  
Hardwood and Decorative Plywood

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Installation; G,RE

Drawings indicating metal thickness, fastenings, details of hinge mechanism, seat and back dimensions, proposed finish, and including seating plans showing row spacing, row lengths, the varying lateral spacing at backs and seats, back pitch, and chair widths for the various section lengths, floor pitch, and riser height, where applicable.

SD-03 Product Data

Theater Chairs; G,RE

Manufacturer's descriptive data, catalog cuts, and installation instructions.

SD-04 Samples

#### Theater Chairs; G,RE

Samples of upholstery, laminate, paint, and plastic finish materials and one complete chair. Fabric samples shall be of sufficient size to show color range, pattern, and finish. Chair sample may be incorporated into the installation, provided it is identified and the location noted.

### 1.3 DELIVERY AND STORAGE

Theater chairs shall be delivered to the site in unopened containers clearly labeled with the manufacturer's name and container contents. Materials shall be stored in a safe, dry, and clean location. Handling of items shall be in a manner that will protect the materials from damage.

### 1.4 WARRANTY

Manufacturer's standard performance guarantees or warranties that extend beyond a one year period shall be provided.

## PART 2 PRODUCTS

### 2.1 MATERIALS

#### 2.1.1 Woven Fabric Upholstery

Woven fabric shall conform to ASTM D 3597, except that it shall be and as indicated by reference on drawings to specific product (F-1). Fabric shall be treated to resist staining and soiling. Color and pattern shall be as scheduled.

#### 2.1.2 Polyurethane Foam

Polyurethane foam shall be high density, fire retardant, nonhardening and nonoxidizing and shall have a high resistance to alkalies, oils, grease, soaps, abrasions, moisture, mildew, and tearing.

#### 2.1.3 Plywood

Plywood shall conform to HPVA HP-1. Unexposed veneers shall be sound grade hardwood or Grade A fir. All face veneers shall be not more than 1/16 inch in thickness, of clear stock, and free from imperfections.

#### 2.1.4 Molded Plastic

Molded plastic shall be high density with a minimum tensile strength of 3300 psi. Material shall be capable of withstanding outdoor temperatures ranging from plus 175 degrees to minus 50 degrees F. Pigments used shall be of such quality to eliminate painting plastic parts. Component surfaces shall have a textured finish.

#### 2.1.5 Armrests

Armrests shall be solid first grade hard maple or walnut with manufacturer's standard natural finish.

#### 2.1.6 Tablet Arm

Each chair shall be equipped with a fold-away tablet arm assembly. Tablet arm shall be fabricated of manufacturer's standard core material faced with plastic laminate. Color shall be as indicated. All edges shall be rounded. When in a writing position, the arm shall lock firmly in place so that it cannot be accidentally disengaged. A spring actuated device shall automatically lock the folded tablet arm in position beside the seat.

### 2.2 CHAIRS

Chair components and assembly shall be free from objectionable projections or irregularities. Corners and edges shall be smooth and rounded. Bolts, nuts, and other fastenings shall be capped. Steel shall be well-formed to shape and size required. Jointing of members shall be welded, riveted, or interlocked. Exposed welds shall be ground and dressed smooth. Casting shall be fine textured, sound, and free of pits, blow holes, and fins. Lines shall be true, accurate, and true-to-pattern with excess metal or imperfections removed. Fastening shall be concealed where possible.

#### 2.2.1 Chair Backs

Back assembly shall consist of an exposed plastic rear panel with an upholstered steel or plywood front panel. Back assembly length shall be between 20 and 27-1/2 inches for a total height of 29 to 38 inches above the floor measured parallel to the back. Rear panel shall completely conceal and protect the rest of the seat assembly when in the raised position. Back shall be fixed type.

##### 2.2.1.1 Plastic Panels

Plastic rear panels shall be one-piece injection molded plastic or high pressure laminated plastic adhered to hardboard or plywood. Texture of plastic panels shall be as selected. Color shall be black.

##### 2.2.1.2 Wood Front Panels

Plywood upholstered front panels shall be fabricated from cross-banded plywood of not less than 3 ply, 3/8 inch thick hardwood veneers.

##### 2.2.1.3 Foam Padding

Polyurethane foam shall be high density, fire retardant and shall be not less than approximately 2 inches in thickness and shall be securely attached to the steel or plywood panel and completely covered with the approved upholstery material.

#### 2.2.2 Seats

Foundation for upholstered seats shall be formed of not less than 20 gauge steel with molded plastic cover or solid molded plastic. The seat



foundation shall be free from visible screws, bolts, open holes, and projections on the bottom, front, and sides. The upholstered seat unit shall be easily removable without removing the foundation unit; and the covering shall be fastened to the frame in a manner that will permit easy reupholstering. Minimum width of seat shall be 18 inches.

#### 2.2.2.1 Steel Seat Units

Upholstered steel seat unit shall be coil-spring type construction or nonsag spring-type construction. Springs shall be attached to a die-formed steel framework. Coil-spring units shall contain no less than 16 coil springs. Springs shall be connected in both directions to control spring axial depression. Nonsag spring units shall contain at least five serpentine design springs suspended under tension; cross bracing, if required, shall be welded to frame so as not to interfere with spring action. Cushions shall be polyurethane foam cemented to burlap sheeting; shall have a minimum thickness of 1-3/4 inches throughout for coil-spring type construction, and 3 inches at front edge, 1-3/4 inches at rear edge, and 1 inch throughout the other portions for nonsag spring units. Panel side covers shall be made without welts. Top and front cover shall have size boxing of fabric upholstery material.

#### 2.2.3 Hinges

Hinges shall be a counterweight mechanism using gravity to return to the upright position or of the full compensating type, completely enclosed, totally independent, free and easy in operation, and capable of compensating for circular installation, variation in installation conditions, and unevenness of floors. Hinge mechanism shall be of the push-back type to allow additional aisle space while in an open position. Each hinge shall have a noiseless, self-rising seat device, shall rise automatically to a uniform safety position of 3/4 fold at all times, and shall fold 100 percent when additional pressure is applied, to provide additional clearance. The hinges shall have oil-impregnated, self-lubricating, metal or brass alloy bearings that will not require further lubrication, or nylon bushings. Hinges shall have a spring tension adjustment mechanism to allow manual compensation for normal wear and fatigue.

#### 2.2.4 Standards

##### 2.2.4.1 Floor Standards

Floor standards shall be tubular steel or sheet steel. The standards shall be formed to fit the floor incline so that the standards will be vertical and the hinge point will be at a height that will maintain proper relation of seat to floor. The feet shall be formed to eliminate tripping hazards and shall have holes for bolt attachment to the floor.

##### 2.2.4.2 Aisle and End Standards

Aisle or end standard panels shall be of the design indicated and shall have decorator panels of laminated plastic. Middle standards shall be designed to match basic aisle or end standard configuration.

#### 2.2.5 Armrests

Armrests shall be black solid plastic.

#### 2.3 FINISH

Metal surfaces shall be given the manufacturer's standard finishes.

#### 2.4 COLOR

Color shall be as indicated.

### PART 3 EXECUTION

#### 3.1 SEATING SYSTEM

The system shall permit the standards to be installed on radial lines from a common center for which concentric circles are determined with each row of units utilizing common middle standards. Standards in each row shall be placed laterally so the aisle-end standards will be in alignment as indicated on seating layout drawing. The angle of inclination of backs shall be adjusted for variations in sightlines. Mechanical attachment of components shall be of sufficient flexibility so that when permanently assembled they will compensate for the changing dimensions laterally between standards caused by convergence toward the center. Seat and back attachments shall absorb inaccuracies in lateral spacing of standards at point of attachment caused by unevenness of floor. Varying lateral dimensions of backs and seats shall be in accordance with approved seating layout. Minimum width of seating unit shall be 20 inches and may be used only to complete a specific row dimension.

#### 3.2 INSTALLATION

Installation of theater chairs shall be in accordance with the seating drawings and approved installation instructions.

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